CAFFEINE AND RISK OF HYPERTENSION

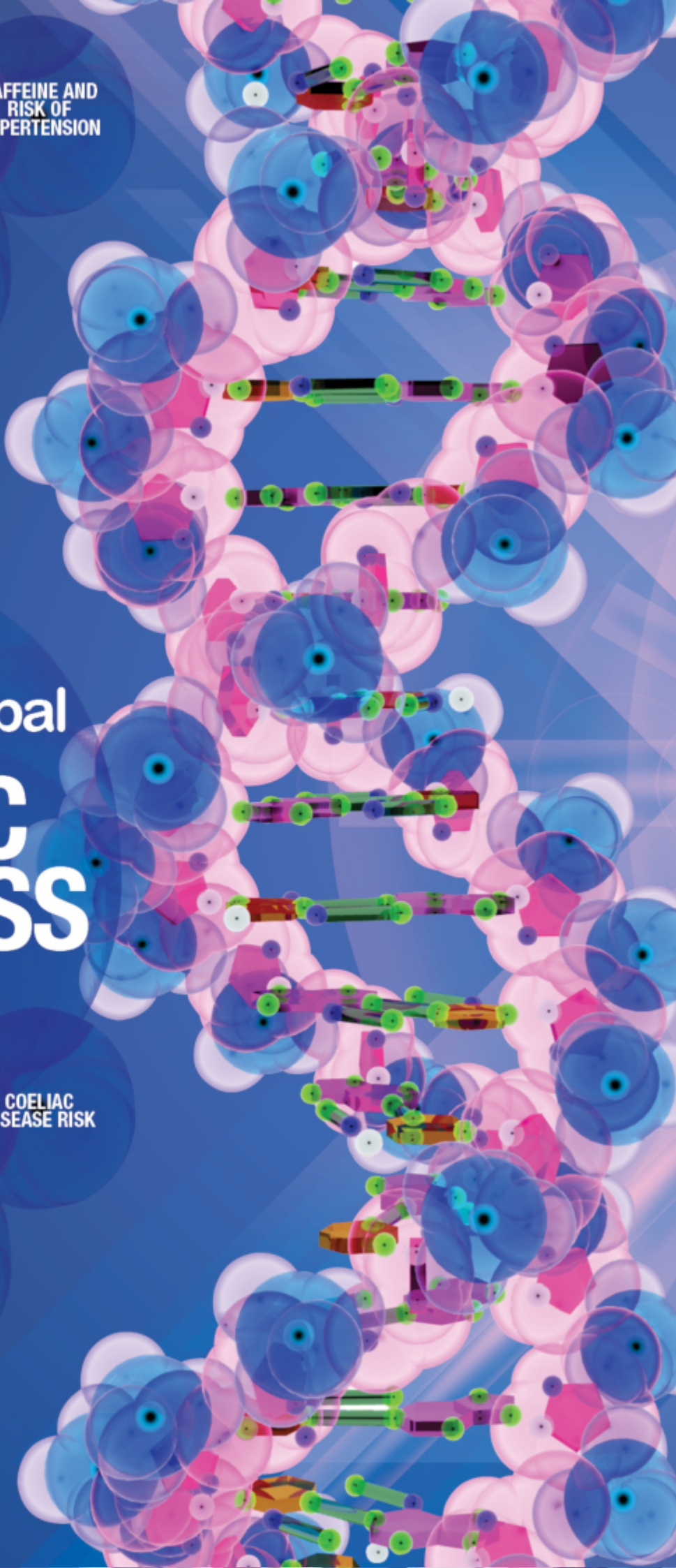
OMEGA-3 FAT AND RISK OF ELEVATED TRIGLYCERIDE LEVELS

VITAMIN E AND ALPHA-TOCOPHEROL BLOOD LEVELS

smartDNAglobal

PRACTITIONERS CHOICE FOR GENOMIC SOLUTIONS

GENOMIC WELLNESS TEST



COELIAC DISEASE RISK

VITAMIN C AND LOW BLOOD LEVELS OF VITAMIN C

WEIGHT LOSS AND CIRCULATING ADIPONECTIN LEVELS

smartDNAglobal.com

Table of contents

Genetic resources for smart practitioners

- **National Human Genome Research Institute**
  Genetics 101 for Health Professionals
  http://www.genome.gov/27527637

- **Genetics Home Reference Page**
  This is a practitioner guide to genes, chromosomes and genetic variations.
  http://www.ghr.nlm.nih.gov/

- **The Pharmacogenomics Knowledge Base**
  Genetics 101 for Health Professionals
  http://www.pharmgkb.org/

- **National Centre for Biotechnology Information (NCBI) OMIM database**

  The On-Line Mendelian Inheritance in Man (OMIM) provides information on the gene analysed and the variants identified. Practitioners are able to enter the gene name and search for information of the gene which includes clinical information, genotype and phenotype correlations and a literature review relating to the gene.

  http://www.ncbi.nlm.nih.gov/omim

- **National Centre for Biotechnology Information (NCBI) - Gene**
  Practitioners can enter the gene name and review the gene and related pathways and publications.
  http://www.ncbi.nlm.nih.gov/gene

- **National Centre for Biotechnology Information (NCBI) – Pubmed**

  Pubmed is a resource of biomedical literature from MEDLINE, Life Science Journals and online books. There are currently more than 22 million citations for biomedical literature.
  http://www.ncbi.nlm.nih.gov/pubmed

- **NuGo – Nutrigenomics Organisation**

  This is a nutritional genomics resource for practitioners.
  www.nugo.org

Genetic test registration information

Patient Identification

Patient Name: Mrs Sally Ann Ehrlich

Patient ID Code: 24974

Aliquot Number: 5392

Patient DOB: 1-10-1964

Patient Gender: Female

Ordering Healthcare Professional

Requesting Practitioner: Jessica Ehrlich

Clinic Address: 25 Abbotts Road Gayndah QLD 4625 Australia

Laboratory Information

Sample Collected: 6-11-2017

Sample Received: 17-11-2017

Sample Reported: 1-12-2017

Test Performed / Method

Genotyping by sequenome based assay.

Test results and gene summary

Patient Name: Mrs Sally Ann Ehrlich	**Patient ID Code:** 24974
Aliquot Number: 5392	**Patient DOB:** 1-10-1964
Submission Number: SDNMS274187	
Patient Gender: Female	**Specimen Source:** Saliva
Clinic Address: 25 Abbotts Road Gayndah QLD 4625 Australia	
Requesting Practitioner: Jessica Ehrlich	
Sample Collected: 6-11-2017	
Sample Received: 17-11-2017	
Sample Reported: 1-12-2017	

IMPORTANT NOTIFICATION FOR PRACTITIONERS: The Action Steps contained within this report are provided as guide for practitioners to discuss and review with their clients. The practitioner should consider the overall health status of their client before making recommendations.

Support Definitions

STAY BALANCED	No risk allele has been inherited
MODERATE RISK	One risk allele has been inherited which has affected the enzyme acivity.
HIGH RISK	One or both risk alleles have been inherited with known effects on enzyme activity.
GENE x NUTRIENT INTERACTION	Outcome is dependent on dietary intake.

Lipid Metabolism

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Lipid Metabolism			
APOE rs429358	TT	INTERMEDIATE CARDIOVASCULAR DISEASE RISK Lipid Metabolism Type A.2 APOE E2/E3 genotype 	• Review Table 1 in relation to soluble fibre, fish oil, energy sources, effects of alcohol and exercise for individuals with this genotype. • Review the gene polymorphisms analysed for this individual in relation to HDL-C, LDL-C, triglyceride and fat absorption. • A low fat and a low cholesterol diet is least effective with APOE E2/E3 individuals, a moderate fat diet (greater than or equal to 30%) is recommended which reduces sdLDL formation. • High glycemic index foods should be reviewed and reduced if necessary since they produce the largest triglyceride response in APOE E2/E3 carriers. • A modified Mediterranean diet high in fibre, fresh fruit, and oily fish will improve triglyceride levels. • Soluble fibre has been reported to have beneficial effects. • Naturally higher antioxidant capacity. • Alcohol has been shown to increase HDL-C and decrease LDL-C in men, there is a reduced effect in females. • APOE E2/E3 allele carriers respond most favourably to statins. • If statins are prescribed then supplement with Co-enzyme Q10. • Niacin has been reported to lower triglyceride levels. • HRT has been shown to improve the lipid profile in this genotype. However, oral estrogen may significantly increase triglycerides. • If the individual smokes they should stop since this is an intermediate cardiovascular disease risk genotype.
APOE rs7412	CT		

Lipid Metabolism - HDL

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
PUFA Dietary Fat			
APOA1 rs670	AG	HIGHER HDL-C level in the blood. 	• From this individual's cholesterol profile determine if their HDL-C level is protective, if it is NOT protective, • then increase PUFA intake to >8% of calories. • Monitor the individuals HDL-C blood level with a cholesterol profile. • Review the LPL, LIPC, and CETP haplotype in this section of the report in relation to increasing HDL-C and APOA1 levels via exercise.
Saturated Fats			
LPL rs320	TT	HIGHER HDL-C levels in the blood in response to lower dietary fat intake. 	• From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then • Review the APOA1 genotype action steps. • Review dietary fat intake. Lower dietary saturated fat intake will elevate HDL-C level. • Review the LPL, LIPC, and CETP haplotype in relation to increasing HDL-C and APOA1 levels via exercise.
LPL rs328	CC		
HDL-C level			
ABCA1 rs2230806	AG	HIGHER HDL-C level in the blood. 	• From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then • Review the APOA1 genotype action steps. • Review dietary fat intake. Lower dietary saturated fat intake will elevate HDL-C level. • Review the LPL, LIPC, and CETP haplotype in relation to increasing HDL-C and APOA1 levels via exercise.
CETP rs5882	AA	HIGHER HDL-C level in the blood. 	• From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then • Review the APOA1 genotype action steps. • Review dietary fat intake. Lower dietary saturated fat intake will elevate HDL-C level.
CETP rs708272	AG		

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
			• Review the LPL, LIPC, and CETP haplotype in relation to increasing HDL-C and APOA1 levels via exercise.
Physiogenomic			
LPL rs10096633	CC	INCREASED HDL-C level and APOA1 level in response to exercise. 	• From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then • Review the APOA1 genotype action steps in relation to dietary PUFA intake. • Refer to Table 2 and Table 3 to review the increase gained in HDL-C level and APOA1 level when exercise is >8 METS per week when compared to <8 METS per week. • Exercise >8 METS per week is recommended to assist with elevating HDL-C and APOA1 level.
LIPC rs1800588	CT		
CETP rs1532624	AC		

Lipid Metabolism - LDL

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
LDL-C level			
APOB rs693	AG	INCREASED LDL-C in response to dietary saturated fat intake. 	• From a cholesterol profile review the LDL-C level, if the LDL level is elevated then, • Review dietary saturated fat intake with the individual and recommend other healthy sources of fats such as plant or fish. • Additional information may be sought from a Liposcan or VAP test in relation to the individual's formation of small dense LDL's and oxidised LDL subfractions.
APOB100 rs754523	AG		
LDL-R rs688	TT		

Lipid Metabolism - Triglycerides

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Triglyceride level			
APOCIII rs5128	CC	Not associated with high triglyceride level. 	• Stay balanced and focus on diet and lifestyle.
APOA5 rs12286037	CC	No increased risk of hypertriglyceridemia. 	• Stay balanced and focus on diet and lifestyle.
APOA5 rs662799	TT	Not associated with high triglyceride level. 	• Review dietary fat intake since individuals with this genotype have been reported to increase their BMI as total fat intake is increased. Women and men are affected equally.
NOS3 rs1799983	GT	HIGH triglyceride level associated with low plasma omega-3 intake. 	• If the triglyceride level is elevated then individuals with this genotype may show greater beneficial effects of omega-3 PUFA consumption in reducing triglyceride concentration.

Lipid Metabolism - Fat Absorption

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Fat Absorption			
FABP2 rs1799883	GG	Not associated with fat absorption. 	• Stay balanced and focus on diet and lifestyle.

Lipid Metabolism - Coronary heart disease risk

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Coronary Heart Disease			
LPA rs10455872	AA	NO increased risk of coronary heart disease. 	• Individuals without risk variant may still develop CHD • It is important to monitor the individual's heart health, diet and lifestyle.

Type 2 Diabetes

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Metabolic syndrome			
ACSL1 rs9997745	GG	INCREASED metabolic syndrome (MetS) risk. 	• Assess dietary fat intake and recommend either a low fat diet (< 35% energy) or a • High PUFA diet (>5.5% energy).
ACC2 rs4766587	GG	NOT associated with increased metabolic syndrome risk. 	• Individuals should stay balanced and maintain a healthy diet.
Glucose level			
G6PC2 rs560887	CC	LOWER fasting glucose level. 	• Assessment of this individual's fasting plasma glucose and glycated haemoglobin A1C may be necessary. • Review the portion size of carbohydrates in meals. • Assess the intake of Low Glycaemic index carbohydrates in the diet. A very low carbohydrate is not necessary.
Insulin secretion			
TCF7L2 rs7903146	CC	DECREASED insulin secretion. 	• Assessment of this individual's fasting plasma glucose and glycated haemoglobin A1C (HbA1C) may be necessary. • Review the portion size of carbohydrates in meals. • Assess the intake of Low Glycaemic index carbohydrates in the diet
WFS1 rs10010131	AG		
Pancreatic Beta cell function			
SLC30A8 rs13266634	TT	Not associated with decreased beta cell function and impaired insulin secretion 	• Recommend that the individual stays balanced and maintains a healthy diet.
Obesity risk			

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
FTO rs9939609	AT	Associated with higher BMI. 	• Assessment of this individual's fasting plasma glucose and glycated haemoglobin A1C may be necessary. • Review the portion size of carbohydrates in meals. • Assess the intake of Low Glycaemic index carbohydrates in the diet.
PPARG rs1801282	CC	Associated with higher BMI. 	• Review dietary fat intake since individuals with this genotype consuming the highest quintile of total fat intake had a significantly higher BMI. • MUFA intake was reported not to be associated with BMI for this genotype. In addition, the PUFA to saturated fat ratio does not affect body weight for individuals with this genotype. • Review the portion size of carbohydrates in meals. • Assess the intake of Low Glycaemic index carbohydrates in the diet. • This does not mean a very low carb diet is necessary.

Inflammation

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Inflammation			
IL-6 rs1800795	CG	NOT associated with higher circulating IL-6 levels. 	• Recommend that the individual stays balanced and maintains a healthy diet. • Practitioners may wish to assess males with this genotype in relation to CRP level and hypertension.
TNFA rs1800629	GG	NOT associated with increased TNF-alpha level. 	• Recommend that the individual stays balanced and maintains a healthy diet.
CRP rs1205	CC	Higher circulating CRP level. 	• Assess low grade chronic inflammation within the clinical context for the individual. • Weight loss has been reported to lower circulating CRP level in the blood.

Food responses

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Sodium Sensitivity			
AGT rs699	CC	INCREASED RISK of sodium sensitivity. 	• Discuss preventative measures in relation to hypertension and cardiovascular disease. • Review the intake of processed foods, snacks, canned foods, cheeses and meats since they have a high salt content.
ACE rs4343	AG		
Caffeine metabolism			
CYP1A2 rs762551	AC	SLOW caffeine metabolism. 	• Reduce caffeine consumption if it exceeds more than two cups of coffee per day since this may increase the risk of hypertension and heart attack. • Reviewing the consumption of caffeinated products may be useful in assessing the individuals overall caffeine intake.
Lactose Intolerance			
MCM6 rs4988235	TT	Lactose tolerant as an adult. 	• Recommend that the individual stays balanced and maintains a healthy diet.
Coeliac			
DQ2.5 rs2187668	- / -	NO increased risk of coeliac disease. 	• Follow up is necessary if the patient is presenting with coeliac disease symptoms. The individual should be referred to a General Practitioner (GP) for further investigations. • Individuals with a family history of coeliac disease with symptoms of coeliac disease should have a consultation with their GP as further investigations may be necessary.
DQ8 rs7454108			

Co-enzyme Q10

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Co-enzyme Q10			
NQO1 rs1800566	CC	NOT associated with reduced NQO1 enzymatic activity. 	• Recommend that the individual stays balanced and maintains a healthy diet.

Omega-3 and Omega 6

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Omega-3 and Omega-6			
FADS1 rs174547	CT	Decreased blood levels of Arachidonic Acid and Eicosapentanoic Acid. 	• Review dietary omega-3 intake and omega-6 intake and improve the intake of omega-3 fatty acids if necessary. • Consider measuring Fatty Acid status including the ratio of omega-3 to omega-6.

Vitamins

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Vitamin B2			
MTHFR rs1801133	CT	REDUCED impact of low blood levels of riboflavin on homocysteine level. 	• Recommend that the individual stays balanced and maintains a healthy diet.
Vitamin B12			
FUT2 rs602662	AG	LOWER levels of B12 in the blood. 	• This result does not mean that the individual's B12 levels are low. • Review dietary intake of vitamin B12. Dietary sources of vitamin B12 for example are meat, fish, eggs and dairy products.
Vitamin C			
SLC23A1 rs33972313	GG	Average blood levels of vitamin C. 	• Maintain a healthy diet and stay balanced by incorporating foods containing vitamin C, for example lemons, oranges, watermelons and strawberries.
GSTT1	PRESENT	INCREASED risk of vitamin C deficiency if individual does not meet the RDI. 	• This result does not mean that the individual's vitamin C levels are out of balance. • Review dietary intake of vitamin C. Sources of vitamin C are lemons, oranges, watermelons and strawberries.
GSTM1	NULL		
Vitamin D			
GC rs2282679	AC	MODERATELY INCREASED risk of vitamin D insufficiency. 	• This result does not mean that the individual's levels are out of balance. • Maintain a healthy diet with dietary sources of vitamin D such as cod liver oil, fish, eggs, mushrooms and fortified dairy products. • Discuss the importance of sunshine exposure with the client and review their daily exposure to sunshine.
DHCR7 rs12785878	GT		
CYP2R1 rs10741657	AG		
Vitamin E			

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
INTERGENIC rs12272004	CC	LOWER plasma levels of alpha-tocopherol. 	• This result does not mean that the individual's levels are out of balance. • Review their dietary intake of vitamin E. • Foods containing naturally occurring sources of vitamin E are eggs, nuts and leafy vegetables.

Methylation

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Methylation			
MTHFR rs1801133	CT	60% -70% reduced enzyme activity. 	• Testing maybe necessary to assess the individual's folate, B12 and homocysteine levels. • Additional functional pathology maybe necessary to assess • 2 and 16 Urinary Oestrogen Metabolites, • Salivary Hormone Profile and a • Functional Liver Detoxification Profile.
MTHFR rs1801131	AC		
Methylation co-factors			
MTR rs1805087	GG	Lower blood homocysteine level. 	• Individuals should maintain a healthy diet and stay balanced.
MTRR rs1801394	GG	INCREASED risk of neural tube defects when vitamin B12 levels are low. 	• Review the MTHFR rs1801133 genotype. If it is "TT" then this variant has been reported to exert a greater effect in pregnant females. • Pathology testing maybe necessary to measure the individuals B12 level.
TCN2 rs1801198	CG	EFFICIENT delivery of vitamin B12 into the cells. 	• Individuals should maintain a healthy diet and stay balanced.
SLC19A1 rs4819130	CT	INCREASED homocysteine level. 	• This result does not mean that the individual's levels are out of balance. • Assess the individual's plasma folate, B6 and B12 levels since homocysteine levels maybe elevated if plasma folate, B6 and B12 is low.
CBS rs234706	CC	High total homocysteine blood level and reduced cystathionine metabolite concentrations.	• This result does not mean that the individual's levels are out of balance. • Homocysteine level maybe increased in individuals with this genotype due to lower CBS activity.

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
			

Choline Deficiency

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Choline			
MTHFD1 rs2236225	GG	NOT associated with higher dietary choline requirements. 	• Maintain a healthy diet with dietary sources of choline such as eggs, cauliflower, almonds and peanut butter.

Oxidative stress

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Oxidative stress			
MnSOD rs4880	CT	REDUCED enzymatic activity. 	• Consider the results in relation to the individual's vitamin and mineral intake and/or dietary intake of antioxidant rich foods.
GPX1 rs1050450	CC	NORMAL enzyme activity. 	• Recommend that the individual stays balanced and maintains a healthy diet.
CAT rs1001179	GG	Normal enzyme activity. 	• Recommend that the individual stays balanced and maintains a healthy diet.

Liver detoxification

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Phase I dextoxification			
CYP1B1 rs1056836	CC	NO INCREASED risk for pro-carcinogen activation. 	• This genotype is associated with reduced activity for pro-carcinogen activation. • Regardless of the CYP1B1 genotype, it is recommended to minimize exposure to PAHs (e.g. smoke and well-done meats), PCBs (e.g. contaminated waste), and dioxins (e.g., chlorine bleaching, PVC plastics, incineration). Maintain a diet rich in antioxidants (colorful fruits and vegetables).
CYP1A1_M1 rs4646903	TT	NORMAL CYP1A1_M1 enzyme activity. 	• This enzyme can be promoted to remove hydrocarbons and accumulated estrogens which do not increase the risk of breast cancer. • Nutrigenetic foods that increase enzyme activity are the brassicas. • It is important that the individual does not smoke or is exposed to fumes and chemicals during up-regulation of the CYP1A1 enzyme.
COMT rs4680	AG	REDUCED enzyme activity. 	• Assess the individual's weight and discuss weight reduction if necessary. • Reduce alcohol consumption if high. • Review and assess the MTHFR enzyme activity. • Reduce stress as this may be a factor associated with reduced enzyme activity. • Discuss the measurement of urinary estrogen metabolites that comprehensively measure 2, 4 and 16 hydroxylated estrogens.
Phase II dextoxification			
GSTP1 rs1695	AA	Normal GSTP1 enzyme activity. 	• Regardless of the GSTP1 genotype is it recommended that the client reduces their exposure to water soluble environmental toxins, including many solvents, herbicides, fungicides, lipid peroxidases and heavy metals such as mercury, cadmium and lead.

GSTT1	PRESENT	Decreased glutathione conjugation capacity. 	• Discuss the importance of cruciferous vegetables in supporting the Glutathionation pathway. • To increase glutathione capacity it is important to ensure availability of precursors and co-factors. • Glutathione depletion can be supported with a-lipoic acid, taurine or milk thistle. • Review the individual's exposure to water soluble environmental toxins and heavy metals. If the exposure to environmental toxins is increased then discuss risk reduction strategies.
GSTM1	NULL		

Weight Management

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Cardiovascular Health			
NPY rs16139	TT	NO effect on total cholesterol and LDL-C in obese individuals. 	• Recommend that the individual stays balanced and maintains a healthy diet however metabolic health should be monitored for all individuals.
PPARD rs2016520	AA	Normal impact on HDL-C level with exercise when compared with individual's harbouring a 'G' allele. Please review the action steps and comments in relation to this result. 	• Review daily exercise and via a cholesterol profile ensure that the individuals HDL-C is protective. • Review the LPL, LIPC and CETP genes in the Lipid Metabolism Panel as exercise of >8 METS/week demonstrated overall positive impact on HDL-C level.
SFA			
APOA2 rs5082	TT	REDUCED risk of obesity related to saturated fatty acid (SFA) intake. 	• Maintain a healthy diet and stay balanced. • Review the Lipid metabolism panel to assess dietary fat intake.
MUFA			
APOA5 rs662799	TT	INCREASED BMI with high fat diet. 	• Review of this individual's diet in relation to their consumption of dietary fat. This variant does not exert and effect in those individuals that do not consume more that 30% of their calories from fat. • Monounsaturated fatty acids (MUFA) showed the highest statistical significance for this interaction
Bitter taste			
TAS2R38 rs713598	GG	TASTER of bitter flavours in cabbage, soy, broccoli, coffee and green tea.	• Individuals with this genotype may use higher amounts of salt to mask the bitter flavour therefore • Review of the salt sensitivity genotype is important and staying within the recommended dietary

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
			guidelines for salt intake.
Satiety			
FTO rs9939609	AT	INCREASED risk of obesity and difficulty feeling full. 	• Review dietary eating patterns and types of foods consumed. • Fibre intake improves feelings of satiety as do low GI fruits and vegetables.
Energy balance			
MC4R rs17782313	CT	INCREASED risk of having a higher BMI due to increased snacking. 	• Review the individuals diet and • discuss exercise as part of a weight management plan • Discuss stress reduction strategies.
Food addiction			
DRD2 rs1800497	CT	INCREASED risk of overeating and addictive behaviours. 	• Discuss strategies to reduce overeating and addictive behaviours. • Discuss the benefits of exercise to reduce food cravings and to stimulate the release of endorphins.
Sugar Consumption			
SLCA2 rs5400	CT	INCREASED risk of consuming sugary foods. 	• Review dietary intake of sweet and sugary foods. • Discuss strategies to reduce sugary foods and substitute with unprocessed natural alternatives. • Review the diabetes risk genotype for this individual.
Adiponectin level			
ADIPOQ rs17366568	AA	LOWER circulating adiponectin level. 	• Weight loss has been shown to improve circulating adiponectin levels.
Weight loss			
ADRB2 rs1042713	GG	INCREASED risk of abdominal and central obesity. 	• Discuss and review with the individual the attenuated weight loss that may be experienced by this individual. • Set realistic weight loss goals for this individual since weight loss may be slower.

Weight Loss			
ADRB3 rs4994	CC	IMPAIRED regulation of lipolysis and thermogenesis. 	• Discuss realistic weight loss goals with the individual considering the gene–nutrient interactions reported on for this individual.
Weight regain			
ADIPOQ rs17300539	GG	LIKELY to regain weight. 	• Discuss and review a healthy eating plan including exercise to maintain weight loss. • If the individual has achieved their ideal weight then exercise is recommended to maintain the weight loss since lean body mass and exercise assist increase circulating adiponectin levels.
Metabolic rate			
LEPR rs8179183	GG	NORMAL resting metabolic rate. 	• Maintain a healthy diet and stay balanced. • Exercise will assist with increasing daily calorie requirements and with weight reduction.
High Protein Diet			
FTO rs1558902	AT	IMPROVED benefit from a high protein diet. 	• Review dietary protein intake for weight management and weight loss. • This does not indicate that the individual should not have carbohydrates in their diet. • Discuss the value of low GI carbohydrate intake rather than processed carbohydrates.
BMI reduction			
FTO rs1121980	CT	INCREASED RISK of higher BMI and waistline. 	• Review this individual's exercise routine since it has been shown to reduce BMI in individuals with this genotype.

Physiogenomic analysis

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Obesity/Depression			
BDNF rs6265	GG	INCREASED risk of obesity and depression. 	• Discuss the benefit of exercise in relation to the natural release of endorphins. • Moderate exercise instead of reaching for food may be beneficial for mood and weight management.
Exercise and BP			
EDN1 rs5370	GG	Normal blood pressure. 	• Review exercise activities because it is important for maintaining good cardiovascular health.
Brain health			
KIBRA rs17070145	CC	REDUCED memory and cognitive flexibility. 	• Review daily exercise; establish a regular sleep pattern, play brain games and meditation as these activities have been reported to improve brain health.
BRAIN HEALTH			
BDNF rs6265	GG	NORMAL ACTH and cortisol responses. 	• Recommend that the individual stays balanced and maintains a healthy diet. • Review daily exercise; establish a regular sleep pattern, play brain games and meditation as these activities have been reported to be beneficial to brain health.
HPA axis			
TH rs10770141	CT	INCREASED catecholamine production and blood pressure in response to stress. 	• Discuss the importance of reducing the impact of cold-stressors. The “T” allele is associated with higher catecholamine excretion and greater changes in blood pressure to cold stress, such as cold weather and cold water. • This polymorphism is also associated with “white-coat” hypertension. • It has also been reported that low serum cortisol levels and elevated catecholamine typify anxiety caused physical and emotional stress.

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Stress / Cortisol			
MR rs2070951	CG	INCREASED salivary and plasma cortisol, plasma ACTH in response to a psychosocial stress. 	• A review of perceived stressors for this individual maybe beneficial. • Discuss strategies for reducing stress including relaxation, exercise and lifestyle modifications.
MR rs5522	AA		
Stress / anxiety			
COMT rs4680	AG	DECREASED enzyme function. 	• A review of perceived stressors for this individual may be beneficial. • Discuss strategies for reducing stress including relaxation, exercise and lifestyle modifications. • Review alcohol consumption. • Ensure that there is an adequate intake of vitamin B, magnesium and amino acids.
Weight Loss			
CLOCK rs1801260	TT	NORMAL plasma ghrelin concentrations, no effect on weight loss. 	• Recommend that the individual stays balanced and maintains a healthy diet.
Social activity			
CLOCK rs2412646	GG	NORMAL level of social activity. 	• Recommend that the individual stays balanced.
Seasonal Variation			
NPAS rs6725296	GG	NO influence on weight. 	• Recommend that the individual stays balanced.
Seasonal Variation			
NPAS rs2305160	GG	INCREASED risk of seasonal variation in sleep length, social activity, mood, weight or appetite.	• Discuss seasonal variations with the individual and how this maybe impacting health. • Review lifestyle choices such as diet, stress and physical activity levels.

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
			

Sports and exercise

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
Resistance training			
INSIG2 rs7566605	GG	NOT associated with an increase in fat volume. 	• Strength training is recommended for its overall health benefits for men and women.
Bone density			
COL1A1 rs1800012	GG	NORMAL bone strength and bone mineral density. 	• Recommend that the individual stays balanced.
VDR rs2228570	CC	NOT associated with increased risk of lower bone mineral density and vertebral fractures. 	• Stay balanced and perform weight bearing exercises. • Bone density scans are recommended for females over the age of 40 and males over the age of 50. • If the individual is over the age of 30 and they have not exercised regularly then recommend a program to help maintain bone density.
Sprint or Endurance			
VEGFR2 rs1870377	TT	This haplotype is associated with a mixed endurance and sprint/power phenotype. 	• Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.
ACE rs4341	CG		
ACE rs4343	AG		
ACTN3 rs1815739	CT		
HIF1 rs11549465	CT		
VO2 max response			

Gene and SNP ID	Genotype / Haplotype	Result and interpretation	Action steps and comments
HIF1 rs11549465	CT	LOWER change in VO2 max during and after training. 	• Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.
Lactate removal			
MCT-1 rs1049434	AT	SLOWER removal of lactate from cells which results in longer recovery time. 	• Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.
Power performance			
eNOS3 rs2070744	CT	MIXED endurance and power athletic performance. 	• Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.
Serum ACE activity			
ACE rs4341	CG	HIGHER serum and ACE activity, this represents a mixed profile; endurance and sprint abilities. 	• Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.
ACE rs4343	AG		

Types of dietary fats

This report has information in relation to gene x nutrient interactions therefore it is important to understand the sources of dietary fats. There are three main dietary fat types; unsaturated fats which are further divided into monounsaturated fats (MUFA's) and polyunsaturated fats (PUFA's), saturated fats and hydrogenated fat. Not only do fats provide flavour to food but they have an important role in the absorption of fat soluble vitamins such as vitamin A, D, E and K. We need to maintain a supply of saturated and unsaturated fats in our diets for optimal health. Hydrogenated fats however are not found naturally; being found in fried foods and margarine. Hydrogenated fats also contain transfats which are not healthy and should be avoided.

Unsaturated fats - monounsaturated fats

These are considered to be a good source of dietary fat and are found in avocados, olives, extra virgin olive oil and nuts. Monounsaturated fats (MUFA's) are considered to be good fats since MUFA's can reduce LDL cholesterol in the blood which reduces cardiovascular disease risk.

Unsaturated fats - polyunsaturated fats

These are composed of omega-3 and omega-6 fatty acids. Individuals may need to focus more on omega-3 fatty acid intake since the intake of omega-6 fatty acids is generally much higher than recommended. Omega 3 fatty acids are found in cold water fish such as salmon, sardines, herrings, and mackerel for example. Omega 6 fatty acids are found in vegetable oils, flaxseed, borage oil, for example.

Saturated fats

These fats are mostly found in animal products both meat and dairy; beef, lamb, dark meat of poultry, veal, pork, butter, cheeses, cream. Saturated fats are also found in coconut and palm oil. Not all saturated fats are created equally since some saturated fats are better than others and saturated as also essential for good health.

Trans fats

These fats are found in highly processed foods, fast foods, fried foods, margarine. These fats are not naturally occurring being man made by manufactures to increase the shelf life of certain foods. The fats are associated with poor cardiovascular health with no nutritional benefits.

LIPID metabolism

The Lipid Metabolism section of the report provides optimised analysis of the gene polymorphisms involved in lipid metabolism. It is important that you as the practitioner read the Lipid Metabolism Type (LMT) profile provided. The LMT is determined by the Apopliprotein E (APOE) gene. This test is not deterministic of cardiovascular disease or cognitive decline. Table 1 provides information in relation to soluble fibre, fish oil, energy sources, alcohol and exercise.

It is important to note that no assessment of this individual's total cholesterol, LDL level (Low Density Lipoproteins), HDL (High Density Lipoproteins) level, Triglycerides or small dense LDL (sdLDL) formation can be determined without referring to their cholesterol profile.

In particular, a cholesterol profile that measures small dense LDL-C (LDL-cholesterol) sub-particles and oxidised LDL's is useful in determining atherogenic potential for individuals. Dietary recommendations based on high cholesterol levels often have no effect or are counterproductive. The solution to the problem is to identify the cause of the high cholesterol level. Several relevant factors need to be determined; the relevant LDL-C subfractions, the patients sex and in particular the individuals genetic components. This analysis will assist with determining the patient's atherogenic risk. Blood lipids, in particular cholesterol, play an important role in the development of vascular diseases. If too much cholesterol is present in the blood, damage to the arterial walls may be caused in the long term. This is how arteriosclerosis may develop and the risk of cardiac infarction increases. In simple terms, there are two different forms in which the water-insoluble cholesterol (blood lipid) is transported in the body. The blood lipids have to be coupled to proteins. A distinction is made between HDL-C (HDL-cholesterol) and LDL-C. The HDL-C level in the blood indicates how much cholesterol from the periphery returns to the liver and thus did not get adhered to the vessels. This is why this value should be as high as possible. Therefore, this parameter is also called "good" cholesterol. A high LDL-C level, however, indicates that cholesterol is circulating in the body and can settle on the vascular walls. This is why LDL-C is called "bad" cholesterol. This level should be as low as possible. There are some subclasses of LDL-C that differ with respect to size. The small LDL-C fractions are particularly relevant to atherogenic potential because they are particularly oxidisable. The following gene polymorphisms give the practitioner information about the polymorphisms harboured by the patient. The genes tested are not an exhaustive list of genetic contributions. However, there is enough published material for them to be included in this risk assessment.

Gene Selection

Genetic variations detected in the Lipid Panel have been associated with inefficient lipid transportation, lipid absorption and lipid metabolism. Dietary changes in particular responses to polyunsaturated fats (PUFA), omega- 6 fatty acids and saturated fats and exercise may improve HDL-C, LDL-C, triglyceride level and fat absorption. Dietary fats are broken down by our digestive system into smaller molecules which are then absorbed into the blood stream. The measurable level of fats in the blood is due to a combination of the fats consumed from the diet and our genes.

Apolipoprotein E Gene

Apolipoprotein E (APOE) is responsible for the production, delivery, and utilization of cholesterol in the body. Variations in APOE function lead to variations in cholesterol levels in the blood as well as in other tissues. High blood cholesterol is a major risk factor for cardiovascular disease. It is for this reason that the APOE genotype or Lipid Metabolism Type is used as the main dietary hub.

APOE genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
APOE rs429358	TT		**INTERMEDIATE CARDIOVASCULAR DISEASE RISK***
APOE rs7412	CT		The APOE E2/E3 genotype has a gene frequency of 15% of most populations. This APOE E2/E3 genotype is associated with lower LDL-C, higher HDL-C, higher triglycerides and increased VLDL, when compared with other genotypes. Therefore metabolic syndrome is a risk factor for this genotype due to reduced clearance of dietary fat. Please review the action steps and comments in relation to this result.

What does this APOE genetic test result mean?

INTERMEDIATE CARDIOVASCULAR DISEASE RISK

This result indicates that this APOE E2/E3 genotype is associated with lower LDL-C and higher HDL-C and increased VLDL level.

ACTION STEPS and comments:

- Review Table 1 in relation to soluble fibre, fish oil, energy sources, effects of alcohol and exercise for individuals with this genotype.
- Review the gene polymorphisms analysed for this individual in relation to HDL-C, LDL-C, triglyceride and fat absorption.
- It has been reported that a low fat and low cholesterol diet is least effective with APOE E2/E3 individuals, a moderate fat diet (greater than or equal to 30%) is recommended. A low fat diet in this geno-group increases the risk of sdLDL formation.
- A modified Mediterranean diet high in fibre, fresh fruit, and oily fish will improve triglyceride levels.
- This genotype has been reported to have a naturally higher anti-oxidant activity when compared to the LMT B and LMT C geno groups.
- High glycemic index foods should be reviewed and reduced if necessary since they produce the largest triglyceride response in APOE E2/E3 carriers.
- Fish oil has been reported to reduce triglycerides.
- Soluble fibre has been shown to have beneficial effects.
- Alcohol has been shown to increase HDL-C and decrease LDL-C especially in males. A reduced effect was reported in females.
- APOE E2/E3 allele carriers respond most favourably to statins.
- If statins are prescribed then supplement with Co-enzyme Q10.
- Niacin has been reported lower triglyceride levels.
- HRT has been shown to improve the lipid profile in this genotype. However, it should be noted that oral estrogen may significantly increase triglycerides.
- If the individual smokes they should stop since this is an intermediate cardiovascular disease risk genotype.

*There are three common variants of the APOE gene: E2, E3, and E4. Since human cells have two copies of each gene, there are six APOE genotypes: LMT A.1 or E2/E2, LMT A.2 or E2/E3, LMT B.1 or E3/E3, LMT B.2 or E2/E4, LMT C.1 or E3/E4, and LMT C.2 or E4/E4. The frequencies of these gene variations differ across ethnicities.

Table 1: LIPID TYPES, GENERAL DIETARY GUIDELINES AND EXERCISE

Cholesterol profiles ought to be used to monitor each individual with respect to HDL-C, LDL-C and triglyceride levels.

		APOE ε2 General Dietary Guidelines		APOE ε3 General Dietary Guidelines		APOE ε4 General Dietary Guidelines	
Lipid Metabolism Type		LMT A.1	LMT A.2	LMT B.1	LMT B.2	LMT C.1	LMT C.2
Genotype		ε2/ ε2	ε2/ ε3	ε3/ ε3	ε2/ ε4	ε3/ ε4	ε4/ ε4
Population Frequency		1%	10-15%	50-65%	2%	20-25%	2-5%
Soluble Fibre[1]		YES		YES		YES	
Fish oils[2]		YES		YES		YES*[1]	
Energy Sources[3,4,6]	Fat	35%	30%	25%	25%	20%	20%
	Protein	15%	15%	20%	20%	25%	25%
	Carbohydrate	50%	55%	55%	55%	55%	55%
Moderate Alcohol[5,6]		HDL↑ LDL↓		HDL↑		↓HDL LDL↑	
		Beneficial		Beneficial		NOT Beneficial*[2]	
Exercise[6]	Aerobic Based	55%	55%	50%	50%	75%	75%
	Strength Based	45%	45%	50%	50%	25%	25%

References: 1(a) Wolver et al. Am J Clin Nutr 66, 584-90 (1997) 1(b) Jenkins et al Metabolism 42, 585-93 (1993). 2(a) Varvel et al. www.hdlabinc.com/sciencebulletin 2(2) 2012 (b) Olano-Martin E Atherosclerosis 209; 104-110 (2010) 3. Masson LF et al. Am J Clin Nutr 77:1098-111 (2003) 4. Moreno JA et al. 134:2517-2522 (2004) 5. a) Corella D et al. Am J Clin Nutr 73:736-45 (2001) b) Marques-Vidal et al. Obes Res 11:1200-6 (2003) c) Mukamal KJ et al., Atherosclerosis 173:79-87 (2004) d) Bleich S et al. J Neural Trans 110:401-11 (2003). e) Lussier-Cacan et al. Arterioscler Thromb Vasc Biol 1:22:824-31 (2002) 6. a) www.ApoegeneDiet.com b) Bernstein et al. Arterioscler Thromb Vasc Biol 22: 133-140 (2002) *[1] Minihane et al Arterioscler Thromb Vasc Biol 20; 1990-1997 (2000) and Olano-Martin E et al. Atherosclerosis 209:10-4-110 (2010) reported genotype x treatment interaction in response to fish oil treatment. *[2] Males are more susceptible than females in this Geno-group to the effects of alcohol on HDL-C and LDL-C. The information for each geno-group does not mean that an individual should be treated equivocally.

HDL cholesterol profile

The well-established inverse relationship between plasma HDL-C levels and the risk of coronary artery disease (CAD) has led to an extensive search for genetic factors influencing HDL-C concentrations. Environmental and metabolic factors that are commonly associated with low HDL-C concentrations include alcohol consumption, dietary saturated fat intake, decreased exercise, cigarette smoking, obesity and diabetes. In addition to environmental factors, strong evidence also exists for the role of genetics in determination of HDL-C level. HDL-C is a heritable characteristic with hereditary estimates in the range of 40-60%. Certain gene polymorphisms have been shown to negatively impact plasma HDL-C level; Apopliprotein A1 (APOA1) can regulate the expression of HDL-C by the percentage of polyunsaturated fatty acids in the diet, especially in females. Lipoprotein Lipase or LPL is involved in breaking down fat molecules which enter the blood stream from food which has been ingested. The fat molecules remain for approximately one hour as an emulsion in the blood. Lipase is responsible for splitting these fat molecules. The LPL polymorphisms analysed have an influence on lipase activity and HDL-C level in response to dietary saturated fat intake. ATP-binding cassette transporter ABCA1 (member 1 of the human transporter sub-family ABCA) is also known as the cholesterol efflux regulatory protein. ABCA1 is a major regulator of cellular cholesterol and phospholipid homeostasis. With cholesterol as its substrate, this protein functions as a cholesterol efflux pump in the cellular lipid removal pathway. In addition to gene-diet interactions, exercise is known to have a positive impact on HDL-C level. It has recently been reported that polymorphisms in the LPL, LIPC and CETP genes elevate HDL-C and APOA1 level in response to exercise. The Metabolic Equivalent of Task (MET) or simply metabolic equivalent is used as a means of expressing the intensity and energy expenditure of activities in a way which is comparable among persons of different weight.

COMMENT: Practitioners must assess each gene or combinations of genes and their associated polymorphism in relation to their function or role in lipid metabolism. Genes and their associated polymorphisms interact with nutrients or they will indicate increased risk in relation to their impact on HDL- C. Review the action steps associated with each gene polymorphism within the context of a cholesterol profile. In general terms the individual may require dietary information in relation to Polyunsaturated Fatty Acid (PUFA) intake, saturated fat intake and /or a review of lifestyle and exercise since all of these areas have an impact on HDL-C level.

APOA1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
APOA1 rs670	AG		**HIGHER HDL-C level in the blood.** It has been reported that this APOA1 genotype is associated with high HDL-C level in the blood if PUFA intake is > 6-8% of calories. This result does not mean that the individual has a protective HDL-C level since the individuals PUFA intake must be assessed. Sex specific differences are associated with this gene nutrient interaction. Please review the action steps and comments in relation to this result.

What does this APOA1 genetic test result mean?

This Apopliprotein A1 genotype has been reported to be associated with higher HDL-C level when PUFA intake is >6 to 8% of total calorie intake. The response to increased dietary PUFA intake and elevated HDL-C level was reported to be more effective in both females and males.

There are two types of dietary PUFA; omega-3 and omega 6. Sources of omega 3 are fish oil, cod liver oil, and fish with a high fat content such as herring, mackerel and salmon. Sources of omega 6 are for example safflower oil, sunflower oil, corn oil, dressings and processed foods. Because PUFA intake is skewed more in favour of omega-6 it is recommended that individuals eat more omega-3 foods and monitor omega-6 intake.

ACTION STEPS and comments:

- From this individual's cholesterol profile determine if their HDL-C level is protective, if it is NOT protective,
- then increase PUFA intake to >8% of calories.
- Monitor the individuals HDL-C blood level with a cholesterol profile.
- Review the LPL, LIPC, and CETP haplotype in this section of the report in relation to increasing HDL-C and APOA1 levels via exercise.

LPL genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
LPL rs320	TT		**HIGHER HDL-C levels in the blood** in response to lower dietary fat intake based on this LPL gene haplotype. This LPL haplotype result does not mean that the individual has elevated or protective HDL-C level since the individual's dietary saturated fat intake must be assessed. Please review the action steps and comments in relation to this result.
LPL rs328	CC		

What does this LPL genetic test result mean?

This LPL haplotype is associated with elevated HDL-C levels in the blood in response to lower dietary saturated fat intake. Dietary sources of saturated fat are cheeses, milk, cream, lard, butter, lamb, veal, pork, beef, and the dark meat of chicken. Lipoprotein Lipase or LPL is involved in breaking down fat molecules which enter the blood stream from food which has been ingested. The fat molecules remain for approximately one hour as an emulsion in the blood. Lipase is responsible for splitting these fat molecules. The LPL polymorphisms analysed have an influence on lipase activity and HDL-C level in response to dietary saturated fat intake.

ACTION STEPS and comments:

- From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then
- Review the APOA1 genotype action steps.
- Review dietary fat intake if the individuals HDL-C IS NOT protective since lower dietary saturated fat intake will elevate HDL-C level.
- Review this individual's Physiogenomic results for the LPL, LIPC and CETP gene polymorphisms since they are associated with an increase in HDL-C and APOA1 in response to exercise of >8 METS/week.

ABCA1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ABCA1 rs2230806	AG		**HIGHER HDL-C** level in the Asian population and a lower risk of coronary artery disease in the Asian and Caucasian population based on this ABCA1 genotype. This result does not mean that the individuals HDL-C blood level is protective. Please review the action steps and comments in relation to this result.

What does this ABCA1 genetic test result mean?

This ABCA1 genotype has been reported to be associated with elevated HDL-C level. The ABCA1 gene is a major regulator of cellular cholesterol and phospholipid homeostasis. With cholesterol as its substrate, this protein functions as a cholesterol efflux pump in the cellular lipid removal pathway.

ACTION STEPS and comments:

- From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then
- Review the APOA1 genotype action steps.
- Review dietary fat intake if HDL-C IS NOT protective since lower dietary saturated fat intake will elevate HDL-C level.
- Review this individual's Physiogenomic results for the LPL, LIPC and CETP gene polymorphisms since they are associated with an increase in HDL-C and APOA1 in response to exercise of >8 METS/week.

CETP genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
CETP rs5882	AA		**HIGHER HDL-C level** in the blood based on this CETP haplotype. Please review the action steps and comments in relation to this result.
CETP rs708272	AG		

What does this CETP genetic test result mean?

This CETP haplotype is associated with an elevated HDL-C level. Cholesteryl ester transfer protein (CETP), also called plasma lipid transfer protein, is a plasma protein that facilitates the transport of cholesteryl esters and triglycerides between the lipoproteins. CETP collects triglycerides from very-low-density (VLDL) or low-density lipoproteins (LDL) and exchanges them for cholesteryl esters from high-density lipoproteins (HDL).

ACTION STEPS and comments:

- From this individuals cholesterol profile determine if their HDL-C level is protective, if it IS NOT then
- Review the APOA1 genotype action steps.
- Review dietary fat intake if HDL-C IS NOT protective.
- Review this individuals Physiogenomic results for the LPL, LIPC and CETP gen polymorphisms since they are associated with an increase in HDL-C and APOA1 in response to exercise of >8 METS/week.

LPL,LIPC and CETP genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
LPL rs10096633	CC		**INCREASED HDL-C level and APOA1 level** in response to exercise based on the three genes analysed. An increase in HDL-C level was reported for this genotype in active females when compared to inactive females as indicated by HDL-C and APOA1 levels. The HDL-C and APOA1 increases are genotype specific. Please refer to Table 2 and Table 3 to obtain the reported increases in mg/dl increases for HDL and APOA1 associated with each genotype.
LIPC rs1800588	CT		
CETP rs1532624	AC		

What does this LPL,LIPC and CETP genetic test result mean?

This LPL, LIPC and CETP haplotype is associated with an increase in HDL-C response to exercise. The Metabolic Equivalent of Task (MET) or simply metabolic equivalent is used as a means of expressing the intensity and energy expenditure of activities in a way which is comparable among persons of different weight. An increase in HDL-C level was reported for this genotype in active females when compared to inactive females as indicated by HDL-C and APOA1 level increases which are represented as delta HDL-C and delta APOA1 per allele (see Table 2 and Table 3 for the delta increases to these levels based on each individual gene polymorphism). The mg/dl increases for males is not known. However in general terms exercise has been reported to increase HDL-C blood levels in both sexes. This information provides assistance in relation to how each genotype is impacted by increasing METS to improve HDL-C and APOA1 values.

ACTION STEPS and comments:

- From this individual's cholesterol profile determine if their HDL-C level is protective, if it IS NOT then
- Review the APOA1 genotype action steps in relation to dietary PUFA intake.
- Refer to Table 2 and Table 3 to review the increase gained in HDL-C level and APOA1 level when exercise is >8 METS per week when compared to <8 METS per week.
- Exercise >8 METS per week is recommended to assist with elevating HDL-C and APOA1 level.

Table 2: MEAN HDL-C (mg/dl) LEVELS PER COPY OF THE MINOR ALLELE AT SIGNIFICANT SNPs IN THE ENTIRE COHORT AND ACROSS MEDIAN LEVELS OF PHYSICAL ACTIVITY.

Gene rs number	MET – hours/week [Metabolic equivalent]	Number in each group	Mean (SD) HDL-C per allele, copy mg/dl		
			0 CC	1 CT	2 TT
LPL rs10096633	≤8.8	11,445	51.5	53.9	54.1
	>8.8	11,493	55.2	56.1	57.7
Delta [HDL-C & MET Physical activity]	N/A	N/A	3.7	2.2	3.6
LIPC rs1800588	≤8.8	11,445	51.3	53.0	54.4
	>8.8	11,491	54.4	56.8	59.3
Delta [HDL-C & Physical activity]	N/A	N/A	3.1	3.8	4.9
Gene rs number	MET – hours/week [Metabolic equivalent]	Number in each group	Mean (SD) HDL-C per allele, copy mg/dl		
			0 CC	1 CA	2 AA
CETP rs1532624	≤8.8	11,065	50.0	52.2	55.5
	>8.8	11,130	52.6	55.8	59.4
Delta [HDL-C & Physical activity]	N/A	N/A	2.6	3.6	3.9

Adapted from: Ahmad T et al. Physical Activity Modifies the Effect of LPL, LIPC and CETP polymorphisms on HDL-C levels and the Risk of Myocardial Infarction in Caucasian Women. Circulation and Cardiovascular Genetics 4(1), 74-80 (2011). The delta score in red refers to the mean increase in mg/dl for each genotype. For example LPL rs10096633 CC genotype indicates a 3.7 mg/dl increase in HDL-C when exercise is >8.8 METS.

Table 3: MEAN APOA1 (mg/dl) LEVELS PER COPY OF THE MINOR ALLELE AT SIGNIFICANT SNPs IN THE ENTIRE COHORT AND ACROSS MEDIAN LEVELS OF PHYSICAL

Gene rs number	MET – hours/week [Metabolic equivalent]	Number in each group	Mean (SD) HDL-C per allele, copy mg/dl		
			0 CC	1 CT	2 TT
LPL rs10096633	≤8.8	11,390	148.1	151.1	152.4
	>8.8	11,443	153.0	153.7	154.0
Delta [HDL-C & MET Physical activity]	N/A	N/A	4.9	2.6	1.6
LIPC rs1800588	≤8.8	11,390	147.4	150.6	154.8
	>8.8	11,441	151.2	155.7	161.6
Delta [HDL-C & Physical activity]	N/A	N/A	3.8	5.1	6.8
Gene rs number	MET – hours/week	Number in each group	Mean (SD) HDL-C per allele, copy mg/dl		
			0 CC	1 CA	2 AA
CETP rs1532624	≤8.8	11,065	145.9	149.3	152.9
	>8.8	11,130	149.2	153.8	158.1
Delta [HDL-C & Physical activity]	N/A	N/A	3.3	4.5	5.2

Adapted From: Ahmad T et al. Physical Activity Modifies the Effect of LPL, LIPC and CETP polymorphisms on HDL-C levels and the Risk of Myocardial Infarction in Caucasian Women. Circulation and Cardiovascular Genetics 4(1), 74-80 (2011). The delta score in red refers to the increase in mg/dl for each genotype. For example the LPL rs10096633 CC genotype indicates a 4.9 mg/dl increase in mean ApoA1 level when exercise is >8.8 METS.

LDL cholesterol profile

It is known that blood lipids and in particular cholesterol has an important role in the development of vascular diseases. In simple terms, there are two different forms in which water-insoluble cholesterol (blood lipid) is transported in the body. A distinction is made between these blood lipids which are coupled to proteins; high density lipoprotein or HDL-C and low density lipoproteins or LDL-C. A high HDL-C level in the blood indicates how much cholesterol from the periphery has returned to the liver and therefore did not adhere to the blood vessel walls. A high LDL-C level indicates however that whilst the cholesterol is circulating it can adhere to vascular walls. The LDL-C level should be as low as possible. There are subclasses of LDL that differ in size; smaller LDL particle size is related to increased atherogenic potential. In addition, smaller particles can be more easily oxidised. The gene polymorphisms tested are associated with elevated LDL-C level in response to dietary saturated fat intake. The APOB gene product is the main apolipoprotein of chylomicrons and low density lipoproteins. The Apolipoprotein B gene encodes for the APOB which is the main apopliprotein of chylomicrons. APOB occurs in plasma as two main isoforms, apoB-48 and apoB-100: the former is synthesized exclusively in the gut and the latter in the liver. Apolipoprotein B-100 (APOB100) is a key component of LDL-C with an important role in the binding of LDL to the LDL receptors. The Low Density Lipoprotein Receptor (LDL-R) plays a crucial role in lipid metabolism being responsible for the uptake of lipoproteins into the cells.

COMMENT: Practitioners must assess each gene or combinations of genes and their associated polymorphism in relation to their function or role in lipid metabolism. These genes and their associated polymorphisms have been grouped into a haplotype to indicate sensitivity to dietary saturated fats. Sensitivity to saturated fats is indicated if a risk allele has been inherited in relation to the polymorphism tested.

APOB, APOB100 and LDL-R haplotype genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
APOB rs693	AG		**INCREASED LDL-C in response to dietary saturated fat intake** based on the gene polymorphisms analysed. This result indicates an increased risk of having elevated LDL-C level in the blood based on this haplotype. Please review the action steps and comments in relation to this result.
APOB100 rs754523	AG		
LDL-R rs688	TT		

What does this APOB, APOB100 and LDL-R haplotype genetic test result mean?

This haplotype result indicates that the individual has inherited one or more gene variants associated with increased risk of elevated LDL-C level in response to increased saturated fat intake. This does not mean that the individual currently has an elevated LDL-C level.

ACTION STEPS and comments:

- From a cholesterol profile review the LDL-C level, if the LDL level is elevated then,
- Review dietary saturated fat intake with the individual and recommend other healthy sources of fats such as plant or fish sources.
- Additional information may be sought from a Liposcan or VAP test in relation to the individual's formation of small dense LDL's and oxidised LDL subfractions.

Triglyceride cholesterol profile

A triglyceride (TG, triacylglycerol, TAG, or triacylglyceride)is an ester derived from glycerol and three fatty acids. Triglycerides are a blood lipid that helps enable the bidirectional transference of adipose fat and blood glucose from the liver. Diets high in refined carbohydrates, with carbohydrates accounting for more than 60% of the total energy intake, can increase triglyceride levels. Of note is strong correlation for those with a BMI higher than 28 and insulin resistance. There is evidence that carbohydrate consumption causing a high glycemic index can cause insulin overproduction and increase triglyceride levels in women. Adverse changes associated with carbohydrate intake, including triglyceride levels, are stronger risk factors for heart disease in women than in men. Triglyceride levels may be reduced by moderate exercise and by consuming omega-3 fatty acids. The gene polymorphisms analysed are associated with elevated triacylglycerol level in the blood. Apolipoprotein CIII plays a crucial role in lipid metabolism. This gene polymorphism is associated with a slower breakdown of triacylglycerol which may result in higher blood levels of triglycerides. Apolipoprotein A-V is a protein that in humans is encoded by the APOA5 gene. The protein encoded by this gene is an apolipoprotein and an important determinant of plasma triglyceride levels, a major risk factor for coronary artery disease. It is a component of several lipoprotein fractions including Very Low Density Lipoproteins (VLDL), HDL, and chylomicrons. It is thought that APOA5 affects lipoprotein metabolism by interacting with LDL-R gene family receptors. Nitric oxide synthase 3 (NOS3) is associated with a gene-nutrient interaction between triglyceride level and plasma n-3 PUFA status

COMMENT: Practitioners must assess each gene or combinations of genes and their associated polymorphism in relation to their function or role in lipid metabolism. Review the action steps associated with each gene polymorphism within the context of a cholesterol profile since the individual may have a triglyceride level that is within normal limits in which case they should stay balanced or they may have an elevated triglyceride level. In general terms the individual may require dietary information in relation to weight reduction, refined carbohydrates intake, and exercise.

APOCIII genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
APOCIII rs5128	CC		**NOT associated with high triglyceride,** total cholesterol and glucose levels based on this APOCIII genotype. Please review the action steps and comments in relation to this result.

What does this APOCIII genetic test result mean?

This individual has not inherited the risk allele which has been reported to be associated with high triglyceride, total cholesterol and glucose levels. The APOCIII gene plays a crucial role in lipid metabolism. APOCIII slows down the breakdown of triacylglycerol, which results in higher blood levels of triglycerides. This polymorphism is associated with a 4 times higher risk of hypertriglyceridemia as well as increased risk for cardiovascular disease and the formation of small dense LDL's based on this APOCIII genotype.

ACTION STEPS and comments:

- Stay balanced and focus on diet and lifestyle

APOA5 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
APOA5 rs12286037	CC		**No increased risk of hypertriglyceridemia** and cardiovascular disease based on this APOA5 genotype. Please review the action steps and comments in relation to this result.

What does this APOA5 genetic test result mean?

This individual has not inherited the risk allele which has been reported to be associated with an increased risk of high triglyceride blood levels and cardiovascular disease.

Apolipoprotein A-V is a protein that in humans is encoded by the APOA5 gene. The protein encoded by this gene is an apolipoprotein and an important determinant of plasma triglyceride levels, a major risk factor for cardiovascular disease. It is a component of several lipoprotein fractions including Very Low Density Lipoproteins (VLDL), HDL, and chylomicrons. It is thought that APOA5 affects lipoprotein metabolism by interacting with LDL-R gene family receptors.

ACTION STEPS and comments:

- Stay balanced and focus on diet and lifestyle

APOA5 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
APOA5 rs662799	TT		**NOT associated with high triglycerides** based on this APOA5 genotype. Special diet recommendations are not necessary. The majority of the population has the ‘TT’ constellation and shows a standard dose response to increasing the proportion of calories attributable to lipids. Please review the action steps and comments in relation to this result.

What does this APOA5 genetic test result mean?

This individual has not inherited the risk allele reported to be associated with elevated triglycerides.

ACTION STEPS and comments:

- Review dietary fat intake since individuals with this genotype have been reported to increase their BMI as total fat intake is increased. Women and men are affected equally.

NOS3 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
NOS3 rs1799983	GT		**HIGH plasma triglyceride level is associated with low plasma omega-3 intake** based on this NOS3 gene polymorphism. Please review the action steps and comments in relation to this result.

What does this NOS3 genetic test result mean?

This genotype is associated with a gene nutrient interaction between triglyceride level and plasma omega-3 PUFA status whereby increasing omega-3 intake has been reported reduce plasma triglyceride levels. Individuals with this genotype are more responsive to omega-3 PUFA intake.

ACTION STEPS and comments:

- From this individual's cholesterol profile determine if their triglyceride level is elevated, if it exceeds normal limits then,
- Individuals with this genotype may show greater beneficial effects of omega-3 PUFA consumption in reducing triglyceride concentration.

Fat absorption

Fatty acid-binding protein 2 (FABP2) is a protein that in humans is encoded by the FABP2 gene. Intestinal fatty acid-binding protein 2 gene is an abundant cytosolic protein in small intestine epithelial cells. The analysed polymorphism provides information on the absorption of fat in the small intestine. Since fat has a high energy value and the polymorphism is associated with increased fat absorption in the intestine it is important to ensure that the individual does not gain weight.

FABP2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FABP2 rs1799883	GG		**NOT associated with increased fat** absorption in the small intestine based on this FABP2 genotype. Please review the action steps and comments in relation to this result.

What does this FABP2 genetic test result mean?

This individual has not inherited the risk allele associated with increased fat absorption in the small intestine.

ACTION STEPS and comments:

- Stay balanced and focus on diet and lifestyle.

Lipoprotein (a) genetic test result

Lipoprotein (a) is an LDL particle with an inherited apoprotein (a) variant attached. The LPA polymorphism is an intron of the LPA gene, which encodes the apolipoprotein (a) component of the Lp(a) particle. This polymorphism has been found to be associated with risk of CHD.

LPA genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
LPA rs10455872	AA		**NO increased risk** of coronary heart disease based on the LPA polymorphism analysed. Please review the action steps and comments in relation to this result

What does this LPA genetic test result mean?

This individual has not inherited the LPA polymorphism associated with increased risk of coronary artery disease (CAD). The non-carrier frequency is approximately 88% for the Caucasian population. The predominant population studies consisted of Caucasian men and women of European ancestry. The associated-risk has not been studied in the African American, Mexican American or East Asian populations. However, carrier frequencies in these ethnic groups are approximately 2% in African American and Mexican American populations, and less than 1% in East Asian populations.

ACTION STEPS and comments:

- Individuals who have not inherited the LPA risk variant may still develop CHD therefore
- It is important to monitor the individual's heart health, diet and lifestyle.

Type 2 Diabetes

The long-chain acyl CoA synthetase 1 (ACSL1) and acetyl-CoA carboxylase (ACC2) play a key role in fatty acid synthesis and oxidation. Disturbance of these pathways is associated with impaired insulin responsiveness and metabolic syndrome (MetS). Moreover the ACSL1 and ACC2 gene polymorphisms are modulated by dietary fat intake. Genetic variations detected in the Transcription factor 7-like 2 (TCF7L2) and the Wolfram Syndrome 1 (WFS1) have been reported to play a role in insulin function. The Fat mass and obesity associated (FTO) gene, glucose-6- phosphatase, catalytic, 2 gene (G6PC2) and the peroxisome proliferator-activated receptor-gamma (PPARG) gene are associated with an increased likelihood of developing type 2 diabetes due to a higher BMI (FTO), reduced control of blood glucose levels (PPARG and G6PC2) or reduced pancreatic beta cell function Solute carrier family 30 (zinc transporter), member 8 (SLC30A8). The practitioner may also refer to the weight management section if overweight is an issue since additional information is available which may be of assistance.

This result does not mean that the individual has diabetes. Assessment of the individual's metabolic health in association with these gene variants relating to dietary fat intake, dietary n-6 PUFA, insulin secretion and BMI will assist with reducing the risk of type 2 diabetes.

ACSL1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ACSL1 rs9997745	GG		**Increased metabolic syndrome (MetS) risk,** elevated fasting glucose, insulin concentrations and increased insulin resistance based on this ACSL1 gene polymorphism. Please review the action steps and comments in relation to this result.

What does this ACSL1 genetic test result mean?

This individual has two copies of the risk allele. It was reported that GG homozygotes have an increased risk of metabolic syndrome, elevated fasting glucose, insulin concentrations and increased insulin resistance. ACSL1 plays an important role in fatty acid metabolism and triacylglycerol synthesis. Disturbance of these pathways may result in dyslipidemia and insulin resistance which are the hallmarks of MetS.

ACTION STEPS and comments:

- Assess dietary fat intake since MetS risk was abolished among individuals with this genotype consuming either a low fat diet (<35% energy) or a
- high PUFA diet (>5.5% energy).

ACC2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ACC2 rs4766587	GG		**NOT associated with increased risk for metabolic syndrome** (MetS) based on this ACC2 gene polymorphism. Please review the action steps and comments in relation to this result.

What does this ACC2 genetic test result mean?

This individual has not inherited the risk allele associated with Mets. The ACC2 gene plays a key role in fatty acid synthesis and oxidation pathways.

ACTION STEPS and comments:

- The individual should stay balanced and maintain a healthy diet.

G6PC2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
G6PC2 rs560887	CC		**LOWER fasting glucose level** based on the G6PC2 gene polymorphism analysed. Please review the action steps and comments in relation to this result.

What does this G6PC2 genetic test result mean?

The G6PC2 gene polymorphism has been reported to be associated with lower fasting glucose level. Reduced control of fasting blood glucose level is a predictor of CAD and all-cause mortality. SNP rs560887 maps to intron 3 of the G6PC2 gene which encodes glucose-6-phosphatase catalytic subunit-related protein (also known as IGRP), a protein selectively expressed in pancreatic islets. This G6PC2 SNP was reported to be associated with fasting plasma glucose and with pancreatic beta cell function in 3 populations; however, it was not associated with risk of type 2 diabetes or body mass index (BMI).

ACTION STEPS and comments:

- Assessment of this individual's fasting plasma glucose and glycated haemoglobin A1C (HbA1c) may be necessary.
- Review the portion size of carbohydrates in meals.
- Assess the intake of Low Glycaemic index carbohydrates in the diet since these foods have lower demand for insulin.
- Carbohydrates are important for optimal health so this does not mean a very low carb diet is necessary.

TCF7L2 and WFS1 genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
TCF7L2 rs7903146	CC		**DECREASED insulin secretion** affecting the individual's ability to remove glucose from the blood based on the TCF7L2 and WFS1 gene polymorphisms analysed. This can result in elevated blood glucose or hyperglycaemia. Please review the action steps and comments in relation to this result.
WFS1 rs10010131	AG		

What does this TCF7L2 and WFS1 genetic test result mean?

This individual has inherited the risk alleles associated with decreased insulin secretion which affects the body's ability to remove glucose from the blood. The TCF7L2 and WFS1 genes analysed have been reported to be associated with increased risk for developing type 2 Diabetes.

ACTION STEPS and comments:

- Assessment of this individuals fasting plasma glucose and glycated haemoglobin A1C (HbA1c) may be necessary.
- Review the portion size of carbohydrates in meals.
- Assess the intake of Low Glycaemic index carbohydrates in the diet since these foods have lower demand for insulin.
- Carbohydrates are important for optimal health so this does not mean a very low carb diet is necessary.

SLC30A8 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
SLC30A8 rs13266634	TT		**NOT associated with decreased pancreatic beta cell function** and impaired insulin secretion based on the SLC30A8 gene polymorphism analysed. Please review the action steps and comments in relation to this result.

What does this SLC30A8 genetic test result mean?

The individual did not inherit the risk allele associated with decreased pancreatic beta cell function and impaired insulin secretion. Gene polymorphisms in the SLC30A8 gene have been reported to be associated with increased risk for developing type 2 diabetes.

ACTION STEPS and comments:

Recommend that the individual stays balanced and maintains a healthy diet.

FTO genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FTO rs9939609	AT		**Associated with higher BMI and increased risk of obesity** which predisposes individuals to type 2 diabetes based on this FTO genotype. Please review the action steps and comments in relation to this result.

What does this FTO genetic test result mean?

The individual has inherited the risk allele associated with increased risk of a higher BMI and predisposition to type 2 diabetes. It has been reported that individuals with two copies of the A allele have difficulty feeling full, food choices and a preference for energy dense foods.

ACTION STEPS and comments:

- Assessment of this individuals fasting plasma glucose and glycated haemoglobin A1C (HbA1c) may be necessary.
- Review the portion size of carbohydrates in meals.
- Assess the intake of Low Glycaemic index carbohydrates in the diet since these foods have lower demand for insulin.
- Carbohydrates are important for optimal health so this does not mean a very low carb diet is necessary.

PPARG genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
PPARG rs1801282	CC		**Associated with a higher BMI** based on this PPARG genotype. In obese individuals this genotype is associated with lower insulin sensitivity. Please review the action steps and comments in relation to this result.

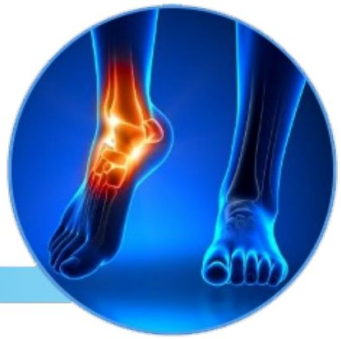
What does this PPARG genetic test result mean?

This individual has inherited the risk allele associated with a higher BMI and lower insulin sensitivity.

ACTION STEPS and comments:

- Review dietary fat intake since individuals with this genotype consuming the highest quintile of total fat intake had a significantly higher BMI compared with those in the lowest quintile when compared with carriers of the G allele.
- MUFA intake was reported not to be associated with BMI for this genotype. In addition, the PUFA to saturated fat ratio does not affect body weight for individuals with this genotype.
- Review the portion size of carbohydrates in meals.
- Assess the intake of Low Glycaemic index carbohydrates in the diet since these foods have lower demand for insulin.
- Carbohydrates are important for optimal health so this does not mean a very low carb diet is necessary.

Inflammation



The inflammatory response is necessary in relation to protection from infection however, chronic inflammation is involved in many disease states including; diabetes, osteoporosis, obesity, aging and cardiovascular disease. Susceptibility to an increased inflammatory response is genetically determined. Common inflammatory cytokines known to be involved in chronic low grade inflammation have been analysed. Tumour Necrosis Factor Alpha (TNFA) is a proinflammatory cytokine which is involved systemic inflammation with possible affects, this does not mean causative, in relation to lipid metabolism, insulin resistance and endothelial function, rheumatoid arthritis and bipolar disorders. Interlukin-6 (IL6) is both a pro-inflammatory and anti-inflammatory cytokine. IL6 is secreted as part of the immune response moderating fever and acute inflammatory responses. Specifically, chronic inflammation triggers a pro-inflammatory response. Increased circulating IL6 levels have been reported to be associated with metabolic conditions such as impaired glucose tolerance, high blood pressure, central adiposity and obesity. The C-Reactive Protein (CRP) gene variant analysed has been reported to have significant correlation with increasing BMI and waist circumference in males and has also been reported to be associated with, though not causal of cardiovascular disease and type 2 diabetes.

IL6 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
IL-6 rs1800795	CG		**NOT associated with higher circulating IL-6 levels** in the blood when compared to healthy individuals carrying the GG genotype. Please review the action steps and comments in relation to this result.

What does this IL6 genetic test result mean?

This individual has not inherited the risk allele reported to be associated with an increased proinflammatory response. This variant is rare in the Asian and African populations.

However, it has been reported that men carrying the C allele had higher levels of the inflammatory marker C reactive protein (CRP) and increased rates of hypertension. The role of IL-6 as a marker for cardiovascular disease has not been fully elucidated.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.
- Practitioners may wish to assess males with this genotype in relation to CRP level and hypertension.

TNFA genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
TNFA rs1800629	GG		**NOT associated with increased TNF-alpha level** or higher circulating levels in the blood. Please review the action steps and comments in relation to this result.

What does this TNFA genetic test result mean?

This individual has not inherited the risk allele associated with a pro-inflammatory response. The 'A' allele genotypes AA and AG are associated with increased TNF-alpha production and higher circulating levels of TNF-alpha in the blood when compared to individuals with the GG genotype.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet

CRP genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CRP rs1205	CC		**Higher circulating CRP level** when compared to individuals harbouring the T allele. Please review the action steps and comments in relation to this result.

What does this CRP genetic test result mean?

This individual has inherited the allele reported to be associated with higher circulating CRP level. The association between measures of adiposity and CRP levels was reported to be dependent on variation in the rs1205 SNP of the CRP gene. A correlation was reported between increases in CRP level with adiposity was accentuated by presence of the C allele in males. In another study of the rs1205 SNP showed increases in CRP levels in both males and females with this genotype.

ACTION STEPS and comments:

- Assess low grade chronic inflammation within the clinical context for the individual.
- Weight loss has been reported to lower circulating CRP level in the blood.

Sodium Sensitivity

The Angiotensin II Receptor Type I (AGT) Gene is a critical hormone controlling sodium and water balance within the body, thereby affecting blood pressure. AGT I is rapidly converted to Angiotensin II (AGT II) by Angiotensin converting enzyme (ACE). AGT II plays a central role in regulating blood pressure and the induction of inflammation in vascular smooth muscle cells. The Angiotensin Converting Enzyme (ACE) Gene Polymorphism is associated with increased susceptibility to hypertension, cardiovascular disease and atherosclerosis. These genes will indicate if the individual is sensitive to sodium or sodium via the renin-angiotensin-aldosterone system.

AGT and ACE genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
AGT rs699	CC		**INCREASED RISK of sodium sensitivity** in response to a high salt intake. There is increased risk of hypertension which is particularly important for individuals who already have hypertension, type 2 diabetes, are overweight or have renal disease. Please review the action steps and comments in relation to this result.
ACE rs4343	AG		

What does this AGT and ACE genetic test result mean?

This individual has increased risk of sodium (or salt) sensitivity and hypertension based on the genetic polymorphisms tested. Additional risk factors are for individuals who already have hypertension, type 2 diabetes, are overweight or have renal disease.

ACTION STEPS and comments:

- Discuss preventative measures in relation to hypertension and cardiovascular disease.
- Review the intake of processed foods, snacks, canned foods, cheeses and meats since they have high sodium content.

Co-enzyme Q10

In the body, CoQ10 must be converted to its usable form in the body. CoQ10 is the inactive form and Ubiquinol is the active form. Ubiquinol as the reduced active antioxidant form of CoQ10 is used in cellular energy processes, it is a strong lipid-soluble antioxidant, and it protects cells from oxidative stress which can cause damage to protein, lipids and DNA. The highest concentration of this essential nutrient is in the heart. Studies have shown that Ubiquinol has superior absorption replenishing the normal CoQ10 plasma concentration more effectively. The transformation from CoQ10 to ubiquinol requires the addition of 2 electrons and 2 hydrogen molecules. NAD(P)H dehydrogenase [quinone] is an enzyme that in humans is encoded by the NQO1 gene. This gene is a member of the NAD(P)H dehydrogenase (quinone) family and encodes a cytoplasmic 2-electron reductase. Recent evidence shows that the NQO1 enzymes maintain ubiquinone (CoQ10) in its quinol form, which can act as an antioxidant protecting membranes from oxidative stress. In vitro studies of the NQO1 rs1800566 polymorphism markedly affect enzyme function. Homozygous variant cells of the rs1800566 polymorphism have complete absence of the NQO1 protein and activity. The result predicted that 5-20% of individuals (depending upon ethnicity) would likely have diminished metabolic activation of bioreductive compounds such as CoQ10. This finding indicates that individuals with this variant may not be effective at reducing CoQ10 to its active form. This is important for individuals that have been prescribed a statin therapy since utilisation of CoQ10 may be reduced.

NQO1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
NQO1 rs1800566	CC		**NOT associated with reduced NQO1 enzymatic activity.** Please review the action steps and comments in relation to this result.

What does this NQO1 genetic test result mean?

This individual has not inherited the risk allele for reduced enzyme activity. This result indicates that CoQ10 reduction to its active form ubiquinol is not affected based on this gene polymorphism.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.
- Utilisation of CoQ10 is not compromised based on this genotype.

Omega-3 and Omega-6 blood levels

A large study has reported that a polymorphism in the Fatty Acid Desaturase 1 (FADS1) gene which produces an enzyme involved in the processing of omega-3 and omega-6 fats had lower blood levels of arachidonic acid (AA), an omega 6 fat, as well as eicosapentanoic acid (EPA) an omega-3 fat.

FADS1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FADS1 rs174547	CT		**Decreased blood levels of Arachidonic Acid (AA) and Eicosapentanoic acid (EPA).** AA is a long chain omega-6 acid and EPA is a long chain omega-3 acid. Please review the action steps and comments in relation to this result.

What does this FADS1 genetic test result mean?

This individual inherited the risk allele for reduced blood levels of AA and EPA based on this FADS1 genotype and as such they may have lower bloods levels of AA and EPA.

ACTION STEPS and comments:

- Review dietary omega-3 intake and omega-6 intake.
- Consider measuring Fatty Acid status including the ratio of omega-3 to omega-6.
- Review the dietary intake of omega-6 fatty acids from processed foods and improve the intake of omega-3 fatty acids since the current ratio is skewed more towards omega-6 fatty acids.

Vitamin B2 metabolism

Riboflavin or vitamin B2 is a component of various coenzymes that play an important role in oxidation and reduction reactions in numerous metabolic pathways, such as those of fats, proteins and carbohydrates. Riboflavin promotes regular patterns of growth and development assisting with energy release from food and is it also part of the electron transport chain which is central to energy production. It plays a key role in mucus membrane maintenance, in fertility and in the maintenance of health of eyes, skin and nervous system. When riboflavin deficiency occurs, symptoms such as dry, red and flaky skin, cracked lips, sore throat and tongue, cracks and sores on the lips, irritated eyes, light sensitivity, poor concentration, memory loss and a burning sensation in the feet are common. Additionally, red blood cell levels may decrease. Riboflavin deficiency frequently occurs in combination with deficiencies of other water-soluble vitamins. It can lead to decreased conversion of pyridoxine (vitamin B6) to coenzymes and decreased niacin (vitamin B3) production. The MTHFR genotype is associated with increased demand for vitamin B2 for individuals with the MTHFR TT genotype since the levels of homocysteine are increased when B2 levels are low. Conversely B2 levels have a smaller effect on individuals with the CC or CT genotypes.

MTHFR genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MTHFR rs1801133	CT		**REDUCED impact of low blood levels of riboflavin on homocysteine level.** Please review the action steps and comments in relation to this result.

What does this MTHFR genetic test result mean?

This individual has not inherited the risk allele associated with increased homocysteine level when B2 level is low based on this genotype.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.

Vitamin B12 metabolism

Vitamin B12 has functional roles including DNA regulation and synthesis and brain and nervous system health. A polymorphism in the FUT2 gene has been reported to be associated with lower blood levels of B12.

FUT2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FUT2 rs602662	AG		**LOWER levels of B12 in the blood** when compared with individuals harboring the AA genotype. Please review the action steps and comments in relation to this result.

What does this FUT2 genetic test result mean?

This individual inherited the risk allele for reduced blood levels of vitamin B12 in the blood based on this FUT2 genotype.

ACTION STEPS and comments:

- This result does not mean that the individual's B12 levels are low.
- Review dietary intake of vitamin B12. Dietary sources of vitamin B12 for example are meat, fish, eggs and dairy products

Vitamin C metabolism

Vitamin C or L-ascorbic acid is unable to be synthesised by humans and must be obtained from dietary sources such as citrus fruits, watermelon, peppers or product fortified with vitamin C. The SLC23A1 gene is involved in the transportation of vitamin C across the cell membrane. The rs33972313 polymorphism is associated with a lower blood level of vitamin C. The glutathione S-transferase (GSTT1 and GSTM1) are detoxifying enzymes that contribute to the glutathione-ascorbic acid (vitamin C) antioxidant cycle. It has been reported the recommended daily intake (RDI) of vitamin C protects against serum ascorbic acid deficiency, regardless of the GST enzyme genotype. However, individuals with GST null genotypes were reported to have an increased risk of deficiency if they did not meet the RDI for vitamin C. The GST enzymes represent a copy number variation and are therefore reported as either present or absent. This means that an individual has either inherited a copy (Present) or not inherited a copy (NULL). Individuals that did not inherit a copy of the GSTT1 or a copy GSTM1 enzyme are reported as a null.

SLC23A1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
SLC23A1 rs33972313	GG		**AVERAGE blood levels of vitamin C.** Please review the action steps and comments in relation to this result.

What does this SLC23A1 genetic test result mean?

This individual has inherited the SLC23A1 genotype that was reported to be associated with average levels of vitamin C in the blood.

ACTION STEPS and comments:

- Maintain a healthy diet and stay balanced by incorporating foods containing vitamin C, for example lemons, oranges, watermelons and strawberries.

GSTT1 and GSTM1 haplotype genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
GSTT1	PRESENT		INCREASED risk of vitamin C deficiency if individual does not meet the RDI. Please review the action steps and comments in relation to this result.
GSTM1	NULL		

What does this GSTT1 and GSTM1 haplotype genetic test result mean?

This individual has increased risk allele for reduced blood levels of vitamin C based on this combined GSTT1 and GSTM1 haplotype. The GST enzymes modify the association between dietary vitamin C and serum ascorbic acid level. Therefore it is important that the individual meets the RDI of vitamin C. Individuals that do not meet the RDI were reported to have significantly lower serum ascorbic acid when compared with the GSTT1 and GSTM1 present genotypes.

ACTION STEPS and comments:

- This result does not mean that the individual's levels are out of balance.
- Review dietary intake of vitamin C. Sources of vitamin C are lemons, oranges, watermelons and strawberries.

Vitamin E metabolism

Vitamin E is a fat-soluble nutrient found in many foods. In the body, it acts as an antioxidant, helping to protect cells from the damage caused by free radicals. Free radicals are compounds formed when our bodies convert the food we eat into energy. People are also exposed to free radicals in the environment from cigarette smoke, air pollution, and ultraviolet light from the sun. The body also needs vitamin E to boost its immune system so that it can fight off invading bacteria and viruses. It helps to widen blood vessels and keep blood from clotting within them. In addition, cells use vitamin E to interact with each other and to carry out many important functions. Although vitamin E sounds like a single substance, it is actually the name of eight related compounds in food, including alpha-tocopherol. The INTERGENIC variant analysed is associated either lower or increased levels of plasma alpha-tocopherol.

INTERGENIC genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
INTERGENIC rs12272004	CC		**LOWER plasma levels of alpha-tocopherol.** Please review the action steps and comments in relation to this result.

What does this INTERGENIC genetic test result mean?

This individual inherited the risk allele associated with reduced blood levels of alpha-tocopherol in the blood based on this INTERGENIC genotype.

ACTION STEPS and comments:

- This result does not mean that the individual's levels are out of balance.
- Review their dietary intake of vitamin E.
- Maintain a healthy diet and incorporate foods containing naturally occurring sources of vitamin E such as eggs, nuts and leafy vegetables.

Vitamin D metabolism

Genetic variations detected in the DHCR7, CYP2R1 and GC genes will indicate if the individual being tested is genetically predisposed to normal, moderate or high level of vitamin D insufficiency. Vitamin D insufficiency has been linked to an increased risk of the following diseases; osteoporosis, fractures, autoimmune diseases such as MS, Crohn's disease, lupus and rheumatoid arthritis, diabetes, depression and mood problems, reduced immunity and some cancers.

DHCR7, CYP2R1 and GC genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
GC rs2282679	AC		**MODERATELY INCREASED RISK of vitamin D insufficiency** based on the genetic variants tested. Please review the action steps and comments in relation to this result
DHCR7 rs12785878	GT		
CYP2R1 rs10741657	AG		

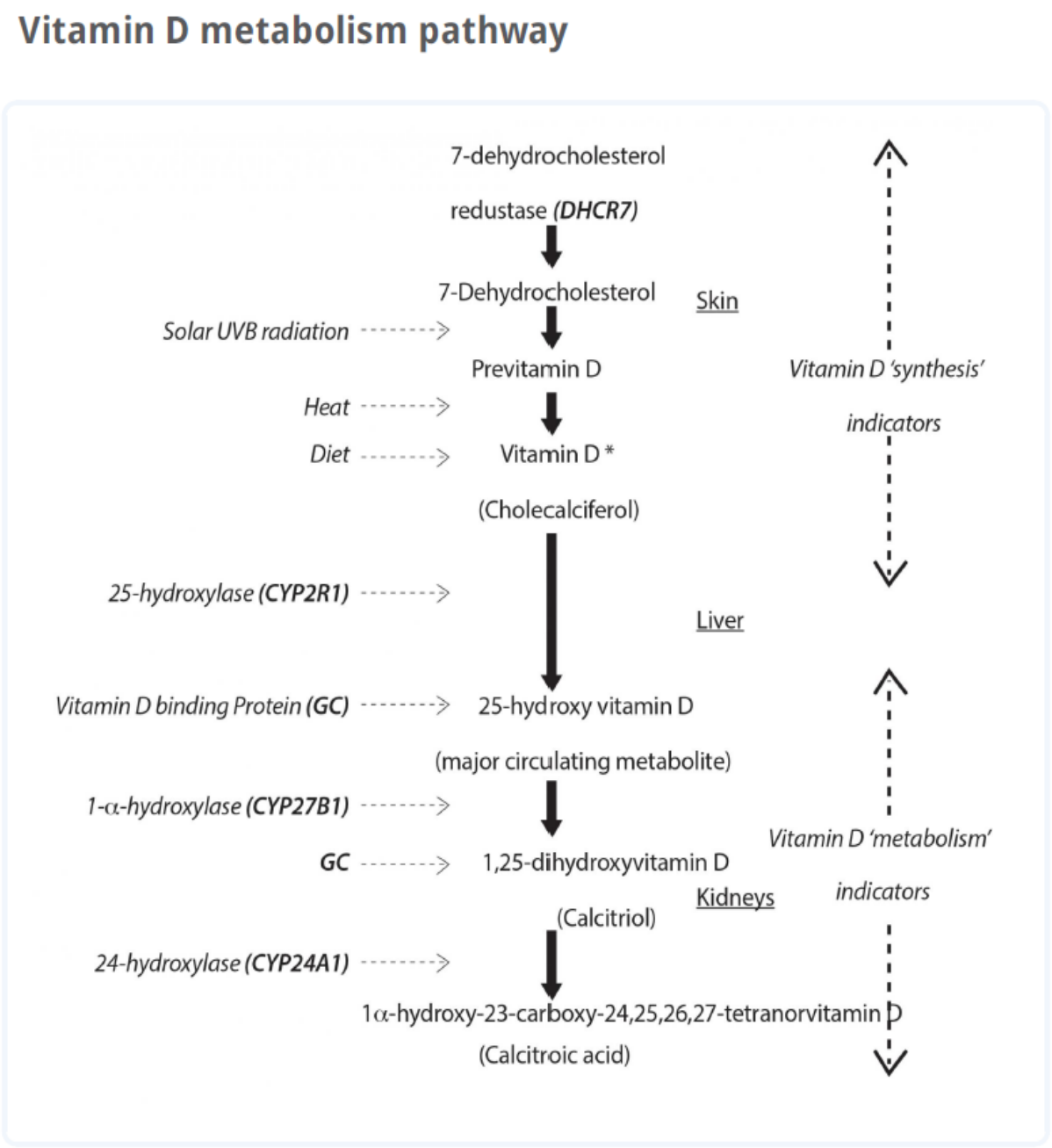
What does this DHCR7, CYP2R1 and GC genetic test result mean?

This individual has inherited the haplotype associated with lower levels of vitamin D (plasma 25-hydroxy-vitamin D) based on the gene polymorphisms analysed.

ACTION STEPS and comments:

- This result does not mean that the individual's vitamin D levels are out of balance.
- Based on this genotype this individual has an increased risk of vitamin D insufficiency when compared to individuals that do not have the same genetic polymorphism.
- Maintain a healthy diet with dietary sources of vitamin D such as cod liver oil, fish especially raw fish, eggs, mushrooms and fortified dairy products.
- Discuss the importance of sunshine exposure with the client and review their daily exposure to sunshine.

Vitamin D metabolism pathway



Skin exposure to ultravoilet B (UVB) radiation initiates the conversion of 7-dehyrocholesterol to previtamin D3. 7- dehydrocholesterol reductase (DHCR7) encodes the enzyme 7-dehydrocholesterol reductase, which converts 7- dehydrocholesterol to cholesterol, thereby removing the substrate from the synthetic pathway of vitmain D3. The previtmain D3 in turn gets converted to vitamin D3 in a heat dependent process. Vitamin D (represents D2 or D3) is transported to the liver, where it is converted by vitamin D-25-hydroxylase (CYP2R1) to 25-hydroxyvitmain D [25(OH)D]. This is the major circulating form of vitamin D that is used by practitioners to determine vitamin D status. This form of vitamin D is biologically inactive; it is bound to the vitamin D-binding protein (GC), (CYP24A1) to catabolise 25(OH)D to the water-soluble, transported to the kidneys and converted to 25-hydroxyvitamin D-1a- hydroxylase (1-OHase) (CYP27B1) to the biologcally active form 1,25-dihyroxyvitamin D3 (Calcitriol). Calcitriol increases the expression of 25-hydroxyvitamin D-24- hydroxylase (24-OHase) biologically inactive calcitroic acid, which is excreted in the bile. DHCR7 and CYP2R1 function upstream of the production of 25(OH)D and hence, termed as 25(OH)D synthesis indicators, while GC, CYP27B1 and CYP24A1 function downstream of the 25(OH)D prodcution and hence, termed as 25(OH)D metabolism indicators.

Methylation

MTHFR genetic variations

The Methylenetetrahydrofolate Reductase (MTHFR) gene encodes MTHFR protein. A distinct combination of two MTHFR gene polymorphisms C677T and A1298C result in the produce an enzyme with 70% reduced activity. Other combinations produce enzymes with different levels of enzyme efficiency. In addition, individuals with particular combinations of these gene variants have higher requirements for vitamin B9 commonly referred to as folate, folic acid or folicin. Folate is required for numerous body functions including DNA synthesis and repair, cell division, and cell growth. A deficiency of folate can lead to anaemia in adults, and slower development in children. For pregnant women, folate is especially important for proper foetal development. Folate or vitamin B9 is a water soluble vitamin that is well regulated by the body; therefore an overdose is rare in natural food sources.

MTHFR genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
MTHFR rs1801133	CT		**60% -70% reduced enzyme activity.** This haplotype is associated with low serum folate and elevated blood homocysteine levels. Please review the action steps and comments in relation to this result.
MTHFR rs1801131	AC		

What does this MTHFR genetic test result mean?

This individual has inherited the risk haplotype associated with INCREASED RISK of reduced folate metabolism or elevated homocysteine level. The risk of low serum folate and high homocysteine levels occurring is elevated if dietary intake of folate and other B group vitamins is not optimal.

ACTION STEPS and comments:

- Pathology testing maybe necessary to assess the individual's folate, B12 and homocysteine levels tested.
- Additional functional pathology maybe necessary to assess
  - 2 and 16 Urinary Oestrogen Metabolites,
  - Salivary Hormone Profile and a
  - Functional Liver Detoxification Profile.

Folate cofactors

The folate cofactors will assist the practitioner in determining if the patient has one or more genetic variations associated with elevated homocysteine level. The MTR, MTRR, TCN2 and SLC19A1 dependent on B group vitamins to function correctly in the folate mediated one-carbon metabolism. The risk associated with polymorphisms in these genes is high homocysteine level and neural tube defect during pregnancy. The CBS genetic variation is associated with a reduced homocysteine blood level, increased betaine and slightly increased cystathionine level.

MTR genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MTR rs1805087	GG		**Lower blood homocysteine level.** Please review the action steps and comments in relation to this result.

What does this MTR genetic test result mean?

This individual has inherited the low risk allele which is associated with lower blood homocysteine level when compared to the carriers of the AA MTR genotype.

ACTION STEPS and comments:

- Individuals should maintain a healthy diet and stay balanced.

MTRR genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MTRR rs1801394	GG		**Associated with increased risk of neural tube defects** in pregnant females when vitamin B12 levels are low. Please review the action steps and comments in relation to this result.

What does this MTRR genetic test result mean?

This individual has inherited the MTRR risk allele. The MTRR ‘GG’ genotype and the MTHFR ‘TT’ genotype in association with low B12 increase the female’s genetic risk of neural tube defect.

ACTION STEPS and comments:

- This result does not mean that the individual's levels are out of balance.
- Review the MTHFR rs1801133 genotype. If it is "TT" then this variant has been reported to exert a greater effect in pregnant females.
- Pathology testing maybe necessary to measure the individuals B12 level.

TCN2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
TCN2 rs1801198	CG		**Efficient delivery of vitamin B12 into the cells** which does not affect B12 status. Please review the action steps and comments in relation to this result.

What does this TCN2 genetic test result mean?

This individual has not inherited the risk allele associated with an elevated homocysteine level based on this TCN2 genotype.

ACTION STEPS and comments:

- Individuals should maintain a healthy diet and stay balanced.

SLC19A1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
SLC19A1 rs4819130	CT		**INCREASED homocysteine level.** This genotype increases homocysteine level when plasma folate, B6 and B12 is low. Please review the action steps a nd comments in relation to this result.

What does this SLC19A1 genetic test result mean?

This individual has inherited the risk allele associated with increased homocysteine level based on this SLC19A1 genotype.

ACTION STEPS and comments:

- This result does not mean that the individual's levels are out of balance.
- Pathology testing may be necessary to assess the individual's plasma folate, B6 and B12 levels since homocysteine levels maybe elevated if plasma folate, B6 and B12 is low.

CBS genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CBS rs234706	CC		**Associated with normal enzyme activity, high total homocysteine blood level and reduced cystathionine and betaine metabolite concentrations in healthy individuals.** Please review the action steps and comments in relation to this result.

What does this CBS genetic test result mean?

This individual has inherited the Cystathionine beta-synthase (CBS) enzyme reported to be associated with normal CBS enzyme activity, elevated total homocysteine and reduced cystathionine and betaine metabolite concentrations in healthy individuals . The CBS variant c.699CC (rs234706) is reported to have significant effects in metabolite concentrations of total homocysteine, betaine and cystathionine levels. Cystathionine beta-synthase is the rate limiting step in the transsulfuration pathway that degrades superfluous homocysteine. In addition, the homozygous C genotype is not associated with the highest total homocysteine/cystathionine ratio.

ACTION STEPS and comments:

- This result does not mean that the individual's homocystine blood levels are out of balance.
- Homocysteine level maybe increased in individuals with this genotype due to lower CBS activity.
- Since the assessment protcol may vary for individual practitioners these action steps are a guide only.

Choline deficiency

Choline, folate and homocysteine metabolism are closely interrelated. The pathways for the metabolism of these three nutrients intersect at the formation of methionine from homocysteine. The MTHFD1 SNP rs2236225 alters the delicately balanced flux between 5, 10 methylene- tetrahydrofolate and 10-formyl tetrahydrofolate and thereby influencing the availability if 5-methyl THF for homocysteine remethylation. This increases the demand for choline as a methyl group donor. There is increased risk of having a child with a neural tube defect in mothers with the MTHFD1 SNP rs 2236225 A allele.

MTHFD1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MTHFD1 rs2236225	GG		**NOT associated with higher dietary choline requirements.** Please review the action steps and comments in relation to this result.

What does this MTHFD1 genetic test result mean?

This individual has not inherited the risk allele associated with higher dietary choline requirements based on this MTHFD1 genotype.

ACTION STEPS and comments:

- Maintain a healthy diet with dietary sources of choline such as eggs, cauliflower, almonds and peanut butter.

Caffeine metabolism

Caffeine is one of the most popular and widely used stimulant drugs in the world. Some individuals consume caffeine daily, while others rarely use it at all. Research has shown that doses of caffeine over 300 mg is unhealthy and can be damaging to the brain, and puts significant stress on the heart, liver, and kidneys. Those who are slow metabolisers of caffeine are at a higher risk for organ damage. For example, the average half-life of caffeine in a 20 year old male is 4-6 hours. A female's caffeine half-life is 8-12 hours in contrast to a pregnant female whose caffeine half-life is nearly doubled at 18-22 hours.

CYP1A2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CYP1A2 rs762551	AC		**SLOW caffeine metabolism based on this CYP1A2 genotype.** This genotype is associated with an increased risk of hypertension and heart attack when caffeine consumption exceeds two cups of coffee per day. Please review the action steps and comments in relation to this result.

What does this CYP1A2 genetic test result mean?

This individual has inherited the risk allele associated with slow caffeine metabolism based on this CYP1A2 genotype.

ACTION STEPS and comments:

- Reduce caffeine consumption if it exceeds more than two cups of coffee per day since there is increased risk of hypertension and heart attack with increased consumption of caffeine.
- Caffeine is found in many food and drink products. Reviewing the consumption of caffeinated products may be useful in assessing the individuals overall caffeine intake.

Coeliac disease

Coeliac disease is an autoimmune disorder caused by gluten (a protein found in wheat, rye, oats and barley) which damages the finger like projections or villi lining of the small intestine. The villi become inflamed with reduced villous formation referred to as villous atrophy. This reduction in the surface area of the bowel reduces nutrient absorption to the extent that vitamin deficiencies are often noted in people with coeliac disease owing to the reduced ability of the small intestine to properly absorb nutrients from food. Symptoms include pain and discomfort in the digestive tract, chronic constipation and diarrhoea, failure to thrive (in children), and fatigue, but these may be absent, and symptoms in other organ systems have been described. Serious health conditions may result if the condition is not diagnosed and treated

Coeliac disease genetics

The genes most commonly associated with coeliac disease are the HLA DQ2 and HLA DQ8. Either one a combination of these genes is present in individuals with coeliac disease.

This test is not diagnostic of coeliac disease since only one in 30 people (approximately) with one or both of these genes will develop coeliac disease. Environmental factors are involved in triggering coeliac disease in childhood and later life.

A referral to a general practitioner is necessary for further testing if the results indicate that the individual has an increased risk of developing coeliac disease during the course of their lifetime. This is irrespective of symptomatology since in a non-symptomatic individual referral for further investigations are warranted. The gold standard test for coeliac disease is a small bowel biopsy. The individual should not eliminate gluten from their diet prior to having a small bowel biopsy.

Coeliac haplotype genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
DQ2.5 rs2187668	- / -		**NO increased risk of coeliac disease** when compared with the general population based on this haplotype.
DQ8 rs7454108			

What does this Coeliac haplotype genetic test result mean?

This result indicates that the individual has not inherited one or more of the genetic markers reported to be associated with coeliac disease.

ACTION STEPS and comments:

- Follow up is necessary if the patient is presenting with coeliac disease symptoms. The individual should be referred to a General Practitioner (GP) for further investigations.
- Individuals with a family history of coeliac disease with symptoms of coeliac disease should have a consultation with their GP as further investigations may be necessary.

Lactose intolerance

Lactose intolerance is a dietary problem arising due to lack of an enzyme called Lactase, produced by cells that line the small intestine. When the enzyme production is low, the body is unable to break down the sugar lactose present in dairy products and it is this unused lactose that is then digested by resident bacteria in the colon. This process sometimes results in symptoms like bloating, diarrhoea, flatulence, abdominal pain or cramps. Lactose intolerance can be classified as primary lactose intolerance or secondary lactose intolerance. Primary lactose intolerance results when the LCT gene stops producing enough lactase. Secondary lactose intolerance is a temporary intolerance caused by trauma to the gut by infection or certain treatments. Genetics can determine if the intolerance is primary intolerance or secondary intolerance.

MCM6 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MCM6 rs4988235	TT		**Lactose tolerant** as an adult based on this MCM6 genotype. However, individuals may be lactose intolerant for other reasons. Please review the action steps and comments in relation to this result.

What does this MCM6 genetic test result mean?

This individual is unlikely to have difficulties digesting milk or dairy products based in this MCM6 genotype.

ACTION STEPS and comments:

- If gastrointestinal symptoms are persisting then further studies may be warranted such as a hydrogen breath test. This test detects hydrogen as a result of lactose not being digested.
- Individuals may be intolerant due to secondary lactose intolerance. Review any medications that the individual may have been prescribed that may affect the bowel flora.

Oxidative stress

Superoxide dismutase is an enzyme that protects cells from increased oxidative stress and free radical damage to cell structures like membranes, mitochondria, DNA and proteins. SOD2 rs4880 is sensitive to inadequate antioxidant intake including environmental exposures that relate to ROS production such as smoking and environmental toxins. Among the antioxidant enzymes involved in protecting against ROS, the GPX1 enzyme plays an important role via the reduction of H2O2 to H2O. The human GPX1 gene contains the rs1050450 SNP which results in a Pro200Leu substitution. GPX1 is a selenoprotein, meaning it incorporates selenium into its protein structure. This polymorphism reduces an individual's ability to utilise selenium. That means that selenium intake needs to be assessed to afford protection to hydrogen peroxide-sensitive tissues, particularly lung and breast tissues. Catalase is a common enzyme found in nearly all living organisms that are exposed to oxygen, where it functions to catalyze the decomposition of hydrogen peroxide to water and oxygen. Catalase has one of the highest turnover numbers of all enzymes; one molecule of catalase can convert millions of molecules of hydrogen peroxide to water and oxygen per second. The rs1001179 CAT polymorphism identified in the promoter region of the human catalase gene has shown that individuals with the variant GA or AA genotypes have significantly lower activity than those with GG genotypes.

MnSOD genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MnSOD rs4880	CT		**Reduced enzymatic activity in relation to risk of cardiomyopathy** associated with iron overload. Please review the action steps and comments in relation to this result.

What does this MnSOD genetic test result mean?

This individual has inherited the risk allele associated with reduced enzyme activity specifically in relation to cardiomyopathy associated with iron overload based on this MnSOD genotype. Among the antioxidant enzymes involved in protecting against reactive oxygen species, the MnSOD gene plays an important role via the reduction of hydrogen peroxide to water and oxygen. There is little overall association between MnSOD and cancer risk, therefore this polymorphism should not be used as general marker for cancer.

ACTION STEPS and comments:

- Consider the results in relation to the individual’s vitamin and mineral intake and/or dietary intake of antioxidant rich foods.

GPX1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
GPX1 rs1050450	CC		**Normal enzyme activity.** Please review the action steps and comments in relation to this result.

What does this GPX1 genetic test result mean?

This individual has not inherited the risk allele associated with reduced enzyme activity. GPX1 is a selenoprotein, meaning it incorporates selenium into its protein structure. This polymorphism reduces an individual's ability to utilise selenium. That means that selenium intake needs to be assessed to afford protection to hydrogen peroxide-sensitive tissues, particularly lung and breast tissues.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.

Catalase genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CAT rs1001179	GG		**Normal enzyme activity.** Please review the action steps and comments in relation to this result.

What does this Catalase genetic test result mean?

This individual has not inherited the risk allele associated with reduced enzyme activity based on this Catalase genotype. Among the antioxidant enzymes involved in protecting against ROS, the catalase gene plays an important role via the reduction of hydrogen peroxide to water and oxygen.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.

Phase I detoxification

Cytochrome P450 1A1 catalyses the 2-hydroxylation of estrone (E1) and estradiol (E2) in to the catecholamines 2- hydroxy estrone (2-OHE1) and 2-hydroxy-estradiol (2-OHE2). These hydroxy metabolites show reduced estrogenic effects behaving more like anti-estrogens when compared with 4-OH and 16-OH metabolites. CYP1A1 also activates pro-carcinogens such as polycyclic aromatic hydrocarbons (PAH) or heterocyclic aromatic amines (HA) present in tobacco smoke and grilled or broiled meat which have been reported to play a role in some cancers; lung and breast. The CYP 450 1A1 rs4646903 SNP increases enzyme activity. CYP1B1 is also part of the CYP 450 family of cytochromes. The CYP1B1 enzyme hydroxylates estrogens into mutagenic 4 hydroxyestrone which creates toxic intermediaries from hydrocarbons that can mimic estrogens and promote estrogen receptor activity. The CYP1B1 rs1056836 SNP is unregulated by xenoestrogens favouring the formation of 4 hydroxyestrone. This increases the risk of prostate cancers in men and breast cancer in females to increased 4 hydroxyestrone which is mutagenic. Both the MTHFR enzyme and COMT enzymes are methylating enzymes, if both enzymes are sub-functional then reduced methylation of hydroxylated estrogens may occur. Reduced methylation of hydroxylated estrogens may result in the accumulation of fat soluble 4 hydroxy estrone which can be further oxidised to catechol quinones which can be DNA damaging and promote oncogenes (cancer genes). The CYP1B1 rs1056836 SNP increases the risk of individuals exposed to hydrocarbon or xenoestrogens. Therefore it is important for individuals to reduce their exposure to xenoestrogens, chemicals and pollutants. Females with the CYP1B1 rs1056836 SNP CG or GG genotypes who smoke were found to have a 2.3 fold increased risk of breast cancer when compared to non-smokers. A threefold increase was reported for long term HRT users.

CYP1B1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CYP1B1 rs1056836	CC		**NO INCREASED risk for pro-carcinogen activation.** Please review the action steps and comments in relation to this result.

What does this CYP1B1 genetic test result mean?

This individual has not inherited the risk allele associated with pro-carcinogen activation based on this CYP1B1 genotype.

ACTION STEPS and comments:

- This genotype is associated with reduced activity for pro-carcinogen activation.
- No special recommendations are required. However, regardless of CYP1B1 genotype, it is recommended to minimize exposure to PAHs (e.g. smoke and well-done meats), PCBs (e.g. contaminated waste), and dioxins (e.g., chlorine bleaching, PVC plastics, incineration). Maintain a diet rich in antioxidants (colorful fruits and vegetables).

CYP1A1_M1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CYP1A1_M1 rs4646903	TT		**Normal CYP1A1_M1 enzyme activity** and thereby the efficient processing of toxic hydrocarbons and accumulated estrogens. Please review the action steps and comments in relation to this result.

What does this CYP1A1_M1 genetic test result mean?

This individual has inherited the allele associated with normal CYP1A1 enzyme activity based on this genotype.

ACTION STEPS and comments:

- During up-regulation of the enzyme it is important to reduce exposure to smoke or fumes that promote CYP1A1 activity.
- This enzyme can be promoted to remove hydrocarbons and accumulated estrogens which do not increase the risk of breast cancer with this genotype.
- Nutrigenetic foods that increase enzyme activity are the brassicas. The active ingredients being Isothiocyantes and Sulphorophanes.
- It is important that the individual does not smoke or is exposed to fumes and chemicals during up-regulation of the CYP1A1 enzyme.

COMT genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
COMT rs4680	AG		**Reduced enzyme activity.** Being overweight, stress and consumption of alcohol increases this trend. Please review the action steps and comments in relation to this result.

What does this COMT genetic test result mean?

This individual has inherited the risk allele associated with slow enzyme activity. COMT inactivates catecholamines, catechol oestrogens and catechol drugs such as L-DOPA. This polymorphism in the COMT gene results in reduced clearance COMT activity having decreased degradation of these compounds. Reduced methylation of hydroxylated estrogens may also occur. Reduced methylation of hydroxylated estrogens may result in the accumulation of fat soluble 4 hydroxy estrone which can be further oxidised to catechol quinones which can be DNA damaging and promote oncogenes (cancer genes).

ACTION STEPS and comments:

- Assess the individual's weight and discuss weight reduction if necessary,
- Reduce alcohol consumption if high.
- Review and assess the MTHFR enzyme activity to ensure normal enzyme activity in relation to donating methyl groups to COMT.
- Reduce stress as this may be a factor associated with reduced enzyme activity.
- Discuss the measurement of urinary estrogen metabolites that comprehensively measure 2, 4 and 16 hydroxylated estrogens.

Phase II detoxification

The Glutathione-S-transferase enzymes detoxify many water soluble environmental toxins, including many solvents, polycyclic aromatic hydrocarbons, steroids, herbicides, fungicides, lipid peroxidases and heavy metals such as mercury, cadmium and lead. Decreased glutathione conjugation capacity may increase toxic burden and increase oxidative stress. Copy Number Variations in the GSTT1 and GSTM1 enzymes are associated with less effective detoxification of potential carcinogens may confer an increased susceptibility to some cancers. If either or both the GSTT1 or GSTM1 enzymes are ABSENT they are assigned a Null genotype. If either copy is present, it is termed PRESENT. The GSTP1 gene encodes for an enzyme, glutathione S-transferase P1 (GSTP1) located in brain tissue, skin tissue and lung tissue which is involved in Phase II detoxification of carcinogens, xenobiotics, steroids, heavy metals and products of oxidative stress. The GSTP1 rs1695 polymorphism produces a variant enzyme with lower activity and less capability of effective detoxification.

GSTT1 and GSTM1 genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
GSTT1	PRESENT		**Decreased glutathione conjugation capacity** which may increase toxic burden and increase cellular oxidative stress. Please review the action steps and comments in relation to this result.
GSTM1	NULL		

What does this GSTT1 and GSTM1 genetic test result mean?

This individual has inherited at least one copy of the GSTT1 gene and no copies (NULL) of the GSTM1 gene. NULL genotypes are associated with less effective detoxification of potential carcinogens. In the liver, when there is reduced glutathione capacity the mercapturic acid pathway is utilised. Mercapturic acid is a condensation product formed from the coupling of cysteine with aromatic compounds. It is formed as a conjugate in the liver and is excreted in the urine. Glutathione-S-transferase adducts lose glutamate and glycine portions, and are acetylated to form mercapturic acids, which are excreted. Levels of mercapturic in the urine may used as an indicator of exposure to, ethylene dibromide and acrylamide for example.

ACTION STEPS and comments:

- Discuss the importance of cruciferous vegetables in supporting the Glutathionation pathway.
- To increase glutathione capacity it is important to ensure availability of precursors and co-factors.
- Glutathione depletion can be supported with a-lipoic acid, taurine or milk thistle.
- Review the individual's exposure to water soluble environmental toxins, including many solvents, herbicides, fungicides, lipid peroxidases and heavy metals such as mercury, cadmium and lead. If the exposure to environmental toxins is increased then discuss risk reduction strategies.

GSTP1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
GSTP1 rs1695	AA		**Normal GSTP1 enzyme activity.** Please review the action steps and comments in relation to this result.

What does this GSTP1 genetic test result mean?

This individual has not inherited the risk allele associated with reduced enzyme activity based on this GSTP1 genotype.

ACTION STEPS and comments:

- Regardless of the GSTP1 genotype is it recommended that the client reduces their exposure to water soluble environmental toxins, including many solvents, herbicides, fungicides, lipid peroxidases and heavy metals such as mercury, cadmium and lead.

Weight management

This section of the report includes genetic variants whose activities are modified by nutrition and exercise such as saturated fat (APOA2) and monounsaturated fat (APOA5), predisposition to higher total cholesterol (NPY) or attenuated improvement in HDL-C level (PPARD). Genetic information in relation to satiety or feelings of fullness (FTO), Bitter taste perception (TAS2R38) which may increase salty food intake, resistance to weight loss (ADRB2 and ADRB3), increased snacking (MC4R), circulating levels of adiponectin and weight regain (ADIPOQ), increased consumption of sugary foods (SLCA2) and food addiction (DRD2), increased metabolic rate (LEPR) and exercise in relation to weight loss maintenance (FTO).

NPY genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
NPY rs16139	TT		**NO effect on total cholesterol and LDL-C** in obese individuals. Please review the action steps and comments in relation to this result.

What does this NPY genetic test result mean?

The individual has not inherited the risk allele report to be associated with elevated total cholesterol and LDL-C level in obese individuals based on this NPY genotype. The NPY gene is widely expressed in both the central and peripheral nervous system having an important role in the hypothalamic regulation of energy balance; moreover it is a predictor of serum cholesterol levels, particularly in obese individuals.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet however metabolic health should be monitored for all individuals.

PPARD genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
PPARD rs2016520	AA		**Normal impact on HDL-C level with exercise** when compared with individual's harbouring a 'G' allele. Please review the action steps and comments in relation to this result.

What does this PPARD genetic test result mean?

This individual has not inherited the beneficial allele reported to be associated with improved cholesterol, improved insulin sensitivity and a greater positive impact on HDL-C level based on this PPARD genotype. However an attenuated improvement in HDL-C level may be achieved since the LPL, LIPC and CETP genotypes analysed in this report also contribute to improved HDL-C level.

ACTION STEPS and comments:

- Review daily exercise and via a cholesterol profile ensure that the individuals HDL-C is protective.
- Review the LPL, LIPC and CETP genes in the Lipid Metabolism Panel as exercise of >8 METS/week demonstrated overall positive impact on HDL-C level.

APOA2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
APOA2 rs5082	TT		**Reduced risk of obesity related to saturated fatty acid (SFA) intake.** Please review the action steps and comments in relation to this result.

What does this APOA2 genetic test result mean?

This individual has not inherited the risk allele associated with increased risk of obesity related to saturated fat intake being associated with efficient fat processing based on this APOA2 genotype.

ACTION STEPS and comments:

- Maintain a healthy diet and stay balanced.
- Review the Lipid metabolism panel to assess dietary fat intake.

APOA5 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
APOA5 rs12286037	CC		**No increased risk of hypertriglyceridemia** and cardiovascular disease based on this APOA5 genotype. Please review the action steps and comments in relation to this result.

What does this APOA5 genetic test result mean?

This individual has not inherited the risk allele which has been reported to be associated with an increased risk of high triglyceride blood levels and cardiovascular disease.

Apolipoprotein A-V is a protein that in humans is encoded by the APOA5 gene. The protein encoded by this gene is an apolipoprotein and an important determinant of plasma triglyceride levels, a major risk factor for cardiovascular disease. It is a component of several lipoprotein fractions including Very Low Density Lipoproteins (VLDL), HDL, and chylomicrons. It is thought that APOA5 affects lipoprotein metabolism by interacting with LDL-R gene family receptors.

ACTION STEPS and comments:

- Stay balanced and focus on diet and lifestyle

TAS2R38 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
TAS2R38 rs713598	GG		**TASTER of bitter flavours** detected in foods such as cabbage, green tea, soy, raw broccoli, tonic water, coffee and some beers. Please review the action steps and comments in relation to this result.

What does this TAS2R38 genetic test result mean?

This individual has inherited the allele associated with bitter taste based on this TAS2R38 genotype. This TAS2R38 genotype affects the individual's food preferences which may contribute to increased salt intake.

ACTION STEPS and comments:

- This individual may experience a stronger bitter taste when eating these foods.
- it has been reported that individuals with this genotype may use higher amounts of salt to mask the bitter flavour therefore
- Review of the salt sensitivity genotype is important and staying within the recommended dietary guidelines for salt intake.

FTO genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FTO rs9939609	AT		**INCREASED risk of obesity** and difficulty feeling full. Please review the action steps and comments in relation to this result.

What does this FTO genetic test result mean?

This individual has inherited the risk allele associated with increased risk of obesity due to difficulty with feeling full based on this FTO genotype.

ACTION STEPS and comments:

- Review dietary eating patterns and types of foods consumed.
- Fibre intake improves feelings of satiety as does low GI fruits and vegetables.

MC4R genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MC4R rs17782313	CT		**INCREASED risk of having a higher BMI,** increased snacking and higher intakes of total energy, dietary fat and greater long term weight gain. Please review the action steps and comments in relation to this result.

What does this MC4R genetic test result mean?

This individual has inherited the risk allele associated with increased risk of having a higher BMI, increased snacking and higher intakes of total energy, dietary fat and greater long term weight gain based on this MC4R genotype.

ACTION STEPS and comments:

- Review the individuals diet and
- discuss exercise as part of a weight management plan
- Discuss stress reduction strategies.

DRD2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
DRD2 rs1800497	CT		**INCREASED risk of overeating** and addictive behaviours. Please review the action steps and comments in relation to this result.

What does this DRD2 genetic test result mean?

This individual has inherited the risk allele associated with how the brain uses dopamine and therefore the stimulation of the brains reward circuitry based on this DRD2 genotype.

ACTION STEPS and comments:

- Discuss strategies to reduce overeating and addictive behaviours.
- Discuss the benefits of exercise to reduce food cravings and to stimulate the release of endorphins.

SLCA2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
SLCA2 rs5400	CT		**INCREASED risk of consuming sugary foods.** Please review the action steps and comments in relation to this result.

What does this SLCA2 genetic test result mean?

This individual has inherited the risk allele associated with increased risk of consuming sweet and sugary foods based on this SLCA2 genotype.

ACTION STEPS and comments:

- Review dietary intake of sweet and sugary foods.
- Discuss strategies to reduce sugary foods and substitute with unprocessed natural alternatives.
- Review the diabetes risk genotype for this individual.

ADIPOQ genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ADIPOQ rs17366568	AA		**LOWER circulating adiponectin level** compared to individuals with the 'GG' genotype. Please review the action steps and comments in relation to this result.

What does this ADIPOQ genetic test result mean?

This individual has inherited the risk allele associated with a lower circulating level of adiponectin based on this ADIPOQ genotype. Adiponectin is an adipokine but unlike leptin, the leaner your body is the more adiponectin your fat cells will release. Adiponectin enhances muscle tissues ability to use carbohydrates for energy, boosts your metabolism, increases the rate in which your body breaks down fat, and curbs your appetite. Individuals can maximize your adiponectin levels by moving more during the day (getting leaner).

ACTION STEPS and comments:

- Weight loss has been shown to improve circulating adiponectin levels. Therefore if the individual is overweight then weight loss should improve their circulating adiponectin level.
- The circulating level of adiponectin can be measured to ascertain if the level is low for this individual.

ADRB2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ADRB2 rs1042713	GG		**INCREASED risk of abdominal and central obesity.** There is reduced weight loss since mobilisation and signal transduction for mobilising fatty tissue is impaired. Please review the action steps and comments in relation to this result.

What does this ADRB2 genetic test result mean?

This individual has inherited both copies of the risk allele reported to be associated with reduced weight loss and abdominal and central adiposity based on this ADRB2 genotype.

ACTION STEPS and comments:

- Discuss and review with the individual the attenuated weight loss that may be experienced by this individual.
- Set realistic weight loss goals for this individual since weight loss may be slower compared to individuals with the “C” allele.

ADRB3 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ADRB3 rs4994	CC		**IMPAIRED regulation of lipolysis** and thermogenesis. The risk allele is associated with increased BMI and slower weight loss. Please review the action steps and comments in relation to this result.

What does this ADRB3 genetic test result mean?

This individual has inherited the risk allele associated with impaired regulation of lipolysis and thermogenesis based on this ADRB3 genotype. The risk allele is associated with increased BMI and slower weight loss.

ACTION STEPS and comments:

- Discuss realistic weight loss goals with the individual considering the gene–nutrient interactions reported on for this individual.
- Exercise was reported to have a positive impact on individuals with this genotype.

ADIPOQ genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
ADIPOQ rs17300539	GG		**Likely to regain weight.** Please review the action steps and comments in relation to this result.

What does this ADIPOQ genetic test result mean?

This individual has inherited the risk allele associated with an increased risk of weight regain based on this ADIPOQ genotype. Individuals can maximize your adiponectin levels by moving more during the day (getting leaner).

ACTION STEPS and comments:

- Discuss and review a healthy eating plan including exercise to maintain weight loss.
- If the individual has achieved their ideal weight then exercise is recommended to maintain the weight loss since lean body mass and exercise assist with maintaining higher circulating adiponectin levels.

LEPR genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
LEPR rs8179183	GG		**Less calories are required when compared to indviduals with the 'CC' genotype.** This genotype is associated with a normal resting metabolic rate. This means fewer calories are required for metabolic function. Please review the action steps and comments in relation to this result.

What does this LEPR genetic test result mean?

This individual has inherited the allele associated with a normal resting metabolic rate based on this LEPR genotype. The leptin receptor interacts with the brain signalling when and how the individual burns energy. Exercise will improve this individual's metabolic rate and assist with weight management.

ACTION STEPS and comments:

- Maintain a healthy diet and stay balanced.
- Exercise will assist with increasing daily calorie requirements and may assist with weight reduction.

FTO genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FTO rs1558902	AT		**IMPROVED benefit from a high protein diet.** This genotype is associated with improved weight loss including fat free mass (FFM), FFM% and % of trunk fat on a higher protein diet. Please review the action steps and comments in relation to this result.

What does this FTO genetic test result mean?

Individuals with the risk allele (A allele) of the rs1558902 genotype had a greater loss of weight and regional fat in response to a high-protein diet compared with non-carriers, whereas an opposite genetic effect was observed regarding changes in fat distribution in response to a low-protein diet. Dietary protein was reported to modify the FTO variant's effect on changes in body composition and fat distribution. A high-protein diet may be beneficial for weight loss in individuals with the risk allele of an FTO variant.

ACTION STEPS and comments:

- Review dietary protein intake for weight management and weight loss.
- This does not indicate that the individual should not have carbohydrates in their diet. Discuss the value Low GI carbohydrate intake rather than processed carbohydrates.

FTO genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
FTO rs1121980	CT		**INCREASED RISK of higher BMI** and waistline. Please review the action steps and comments in relation to this result.

What does this FTO genetic test result mean?

This individual has inherited the risk allele associated with a higher BMI and waistline based on this FTO genotype. Physical activity was reported to reduce the risk of overweight in individuals with this genotype.

ACTION STEPS and comments:

- Review this individual's exercise routine since it has been shown to reduce BMI in individuals with this genotype.

Physiogenomic analysis

Physiogenomics integrates genotypes, phenotypes and functional variability amongst individuals. A phenotype is a measurable physiological, morphological, biological, biochemical or clinical characteristic. Genotype refers the genetic composition of that individual. The section of the report covers increased risk of obesity and depression (BDNF), blood pressure response to exercise (EDN1), the KIBRA gene and working memory, HPA axis stress responses in particular elevated ACTH and cortisol levels (TH and MR), seasonal variation in sleep, mood, appetite, social activity (NPAS and CLOCK), increased plasma ghrelin level and weight gain (CLOCK).

BDNF genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
BDNF rs6265	GG		**INCREASED risk of obesity and depression.** Please review the action steps and comments in relation to this result.

What does this BDNF genetic test result mean?

This individual has inherited the risk allele associated with an increased risk of obesity and depression based on this BDNF genotype.

BDNF acts on certain neurons of the central nervous system and the peripheral nervous system, helping to support the survival of existing neurons, and encourage the growth and differentiation of new neurons and synapses. In the brain, it is active in the hippocampus, cortex, and basal forebrain—areas vital to learning, memory, and higher thinking. BDNF activity is correlated with increased long term potentiation and neurogenesis, which can be induced by physical activity. Stress and increases in the stress hormone corticosterone will cause decreases in BDNF, and decreases in neurogenesis, and stress itself is associated with the development of major depressive disorder. Not only have that, but individuals with depression actually showed lower levels of BDNF in their blood than people without.

ACTION STEPS and comments:

- Discuss the benefit of exercise in relation to the natural release of endorphins.
- Moderate exercise instead of reaching for food may be beneficial for mood and weight management.

EDN1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
EDN1 rs5370	GG		**Normal blood pressure.** Please review the action steps and comments in relation to this result.

What does this EDN1 genetic test result mean?

This individual has not inherited the risk allele associated with hypertension based on this EDN1 genotype. Exercise has a myriad of benefits therefore regular exercise to recommend for overall health and cardiovascular fitness.

ACTION STEPS and comments:

- Review exercise activities because it is important for maintaining good cardiovascular health.

KIBRA genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
KIBRA rs17070145	CC		**REDUCED memory and cognitive flexibility.** Please review the action steps and comments in relation to this result.

What does this KIBRA genetic test result mean?

This individual has inherited the risk allele associated with reduced memory and cognitive flexibility based on this KIBRA genotype. Individuals with this genotype exhibit lower glucose metabolism than carriers in the posterior cingulate and precuneus brain regions.

ACTION STEPS and comments:

- Review daily exercise; establish a regular sleep pattern, play brain games and meditation as these activities have been reported to improve brain health.

BDNF genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
BDNF rs6265	GG		**NORMAL Adrenocorticotropic hormone (ACTH) and cortisol responses.** Please review the action steps and comments in relation to this result.

What does this BDNF genetic test result mean?

This individual has inherited the allele associated with normal ACTH and cortisol responses to stress based in this BDNF genotype. Brain-derived neurotropic factor (BDNF) contributes to neuroplasticity in the hippocampus especially in response to stress.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.
- Review daily exercise; establish a regular sleep pattern, play brain games and meditation as these activities have been reported to be beneficial to brain health.

Tyrosine hydroxylase genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
TH rs10770141	CT		**INCREASED catecholamine production** and blood pressure in response to stress. Catecholamines are adrenalin and noradrenalin. The release of adrenalin in response to stress stimulates the HPA axis. Please review the action steps and comments in relation to this result.

What does this Tyrosine hydroxylase genetic test result mean?

This individual has inherited the risk allele associated with increased catecholamine production and blood pressure in response to stress based on this TH genotype. The TH gene rs10770141 has been reported to influence biochemical and physiological traits in the sympathetic nervous system as well as hypertension. This variant influences blood pressure in the general population. This variant is associated with low serum cortisol and higher catecholamine excretion and therefore greater changes in blood pressure to cold stress; such as cold air, cold water and high velocity air movement. The increased excretion of catecholamine and lower cortisol in response to cold may induce anxiety caused by perceived physical and emotional stress.

ACTION STEPS and comments:

- Discuss the importance of reducing the impact of cold-stressors. The “T” allele is associated with higher catecholamine excretion and greater changes in blood pressure to cold stress, such as cold weather and cold water.
- Since this polymorphism is also associated with “white-coat” hypertension it is suggested that the individuals delays the taking of blood pressure for 5 minutes to assist with obtaining a more accurate blood pressure reading.
- It has also been reported that low serum cortisol levels and elevated catecholamine typify anxiety caused physical and emotional stress.

MR Haplotype genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
MR rs2070951	CG		**INCREASED salivary cortisol, plasma cortisol,** plasma ACTH and heart rate in response to a psychosocial stress. This Haplotype is a combined grouping of haplotype 1 and haplotype 2. Please review the action steps and comments in relation to this result.
MR rs5522	AA		

What does this MR Haplotype genetic test result mean?

This individual has a combined MR haplotype grouping of haplotype 1 and haplotype 2. These haplotypes represent the two highest salivary cortisol, plasma cortisol and ACTH and heart rate response to psychosocial stress.

ACTION STEPS and comments:

- Stress arises from person-environment interactions, and since stress is also influenced by an individuals personality a review of perceived stressors for this individual maybe beneficial.
- In combination this haplotype is associated with increased autonomic responses in relation to psychosocial stress. This haplotype may be associated with mood changes, higher ACTH responses and anxiety.
- Discuss strategies for reducing stress including relaxation, exercise and lifestyle modifications.

COMT genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
COMT rs4680	AG		**DECREASED enzyme function** and higher levels of dopamine, epinephrine and norepinephrine levels. Individuals with this genotype have higher circulating levels of these neurotransmitters. Please review the action steps and comments in relation to this result.

What does this COMT genetic test result mean?

This individual may exhibit higher anxiety levels, increased adrenaline levels in response to stress, negative mood states and increased limbic activity to unpleasant stimuli based on this COMT genotype. This genotype is associated with pain sensitivity and migraine due to reduced clearance of catecholamines.

ACTION STEPS and comments:

- Since stress arises from person- environment interactions, and stress is influenced by an individuals personality then a review of perceived stressors for this individual may be beneficial.
- Discuss strategies for reducing stress including relaxation, exercise and lifestyle modifications.
- Review alcohol consumption
- Reduce mental stress and environmental stress.
- Ensure that there is an adequate intake of vitamin B, magnesium and amino acids.

CLOCK genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CLOCK rs1801260	TT		**Normal plasma ghrelin concentrations,** no effect on weight loss, sleep duration, not associated with evening preference or, delayed breakfast time. Please review the action steps and comments in relation to this result.

What does this CLOCK genetic test result mean?

This individual has not inherited the risk allele which has been reported to be associated with resistance to weight loss, shorter sleep duration associated with evening preference, higher plasma ghrelin concentrations and a delayed breakfast time based on this CLOCK genotype.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains a healthy diet.

CLOCK genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
CLOCK rs2412646	GG		**NORMAL level of social activity.** Please review the action steps and comments in relation to this result.

What does this CLOCK genetic test result mean?

This individual has not inherited the risk allele associated with lower levels of social activity based on this clock genotype. Circadian clocks guide the metabolic, cell division, sleep-wake, circadian and seasonal cycles. Social activity and social connections are important to wellbeing.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and maintains social connections.

NPAS genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
NPAS rs6725296	GG		**NO influence on weight.** Please review the action steps and comments in relation to this result.

What does this NPAS genetic test result mean?

This individual has not inherited the risk allele associated with metabolic risk factors. Neuronal PAS domain protein 2 (NPAS) is a gene that is involved in circadian, metabolic cell-division, sleep-wake and seasonal cycles.

ACTION STEPS and comments:

- Recommend that the individual stays balanced.

NPAS genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
NPAS rs2305160	GG		**INCREASED risk of seasonal variation** in sleep length, social activity, mood, weight or appetite. Please review the action steps and comments in relation to this result.

What does this NPAS genetic test result mean?

This individual has inherited the risk allele associated with seasonal variation in sleep length, social activity, mood, weight or appetite based on this NPAS genotype. Neuronal PAS domain protein 2 (NPAS) is a gene that is involved in circadian, metabolic cell-division, sleep-wake and seasonal cycles.

ACTION STEPS and comments:

- Discuss seasonal variations with the individual and how this maybe impacting health.
- Review lifestyle choices such as diet, stress and physical activity levels.

Sports and exercise

This sport and exercise panel is designed to give the individual insights into which type of exercise they may be best suited to; sprint or power-based performance versus endurance performance exercise. The overall aim is reduce injury risk for the individual so whilst the individual may have genes associated with sprint performance this does not mean that they have a special talent or that they won't enjoy endurance based sports.

Bone density

The COL1A1 gene variant is associated with lower bone density and the VDR Fok1 gene variant is associated with lower bone density and vertebral fractures. Therefore weight bearing exercise may be beneficial.

Increase in fat volume

It has been reported that males with the INSIG2 gene variant may have small increases in fat volume associated with high intensity strength training.

Endurance or Power based genotype

Endurance genetic variants are associated with a slow twitch muscle fibre type and an efficient cardiovascular system. Slow twitch muscle fibres are capable of producing relatively larger energy units more slowly over time, whereas fast twitch muscle fibres produce relatively smaller units of energy quickly. The explosive power and sprint based performance is genetically associated with a relatively higher proportion of type II fast twitch muscles. Type II muscles can be further classified into Type IIa or intermediate fibres which are involved in both aerobic and anaerobic energy metabolism and Type IIb which provide quicker more powerful energy supply. Genetic variants in the VEGFR2, ACTN3, HIF1 and ACE gene have been analysed to assist in defining if the individual is predisposed to endurance or power/sprint based training.

Maximal Oxygen uptake or VO2 max

The HIF1 genetic result will indicate either an improved VO2 max or a lower change in VO2 max. VO2 max, or maximal oxygen uptake, is one factor that can determine an individual's capacity to perform sustained exercise and is linked to aerobic endurance. VO2 max refers to the maximum amount of oxygen that an individual can utilize during intense or maximal exercise. It is measured as millilitres of oxygen used in one minute per kilogram of body weight. This measurement is generally considered the best indicator of an athlete's cardiovascular fitness and aerobic endurance. Theoretically, the more oxygen you can use during high level exercise, the more ATP (energy) you can produce. This is often the case with elite endurance athletes who typically have very high VO2 max values. V02 max should not be confused with the lactate threshold (LT) or anaerobic threshold (AT), which refers to the point during exhaustive, all-out exercise at which lactate builds up in the muscles during exercise. With proper training, athletes are often able to substantially increase their AT and exercise longer at a higher intensity.

Blood supply to working muscles

Endurance is associated with a good supply of oxygenated blood to muscles during exercise. This allows the individual to expend more energy over a longer period of time. Variations in the gene promoter region of eNOS result in reduced endothelial nitric oxide synthesis. Individuals are classified as being associated with power performance, mixed power or endurance phenotypes. Power performance is associated with jumping, throwing and sprinting events. A mixed power and endurance profile was reported to be over represented in elite soccer players who require both power and endurance to compete.

Recovery

Recovery is an important and over looked aspect in relation to exercise and training. The MCT-1 gene variant provides information in relation to removal of lactate from the cells. If the individual has slow removal of lactate from muscles recovery time may be longer after intense physical exercise and muscle soreness.

General ACTION STEPS and comments:

Consult a health care professional before embarking on an exercise program.
Stretching and warming up is important before any exercise.
It is important to gradually increase the training intensity don't over train and allow for recovery after exercise.
Wear appropriate clothing and if required safety equipment such as eye protection and mouth guards for example.
Hydration is important. Remember to drink fluids before, during and after exercise.

INSIG2 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
INSIG2 rs7566605	GG		• **NOT associated with an increase in fat volume** induced by strength training. Please review the action steps and comments in relation to this result.

What does this INSIG2 genetic test result mean?

This individual has not inherited the risk allele reported to be associated with small increases in fat volume induced by strength training. This effect has not been reported for women.

ACTION STEPS and comments:

- Strength training is recommended for its overall health benefits for men and women.

COL1A1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
COL1A1 rs1800012	GG		**NORMAL production of type 1 collagen**, normal bone strength and bone mineral density. Please review the action steps and comments in relation to this result.

What does this COL1A1 genetic test result mean?

This individual has not inherited the risk allele associated with reduced production of type 1 collagen based on this COL1A1 genotype.

ACTION STEPS and comments:

- Recommend that the individual stays balanced and performs weight bearing exercises.

VDR genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
VDR rs2228570	CC		**NOT associated with increased risk lower bone mineral density and vertebral fractures.** Please review the action steps and comments in relation to this result.

What does this VDR genetic test result mean?

This individual has not inherited the risk allele reported to be associated with lower bone density and vertebral fractures. This vitamin D receptor is referred to as Fok1 variant. The Fok1 homozygous C genotype is associated with a 1.7 fold more active vitamin D variant which is often described as "FF" rather than the "homozygous C" genotype. In relation to bone mineral density FF>Ef>ff which confers a reduced risk for this genotype in relation to bone mineral density.

ACTION STEPS and comments:

- Stay balanced and perform weight bearing exercises.
- Bone density scans are recommended for females over the age of 40 and males over the age of 50.
- If the individual is over the age of 30 and they have not exercised regularly then recommend a program to help maintain bone density.

Sprint and Endurance genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
VEGFR2 rs1870377	TT		**This haplotype is associated with a mixed endurance and sprint/power phenotype.** Please review the action steps and comments in relation to this result.
ACE rs4341	CG		
ACE rs4343	AG		
ACTN3 rs1815739	CT		
HIF1 rs11549465	CT		

What does this Sprint and Endurance genetic test result mean?

Individuals with this haplotype have a mixed muscle fibre type profile giving them the ability to participate in events such as hockey and netball through to activities that require power performance such as yoga and pilates.

ACTION STEPS and comments:

- Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.
- Review the exercise activities that the individual engages in since this haplotype grouping enables the individual to engage in activities such as yoga, netball, hockey, soccer, running, circuit training and basketball for example. This is information is a general guide only for the individual to consider in relation to exercise.

HIF1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
HIF1 rs11549465	CT		Lower change in VO2 max during and after training. Please review the action steps and comments in relation to this result.

What does this HIF1 genetic test result mean?

This individual has inherited the risk allele which is associated with attenuated improvements in VO2 max compared to individuals with the HIF1 CC genotype. This HIF1 genotype IS NOT critical in determining sprint performance since it has been reported that it is the combination of HIF1 and ACTN3 genotypes that determine sprint performance.

ACTION STEPS and comments:

- Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.

MCT-1 genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
MCT-1 rs1049434	AT		**SLOWER removal of lactate from cells** which results in longer recovery time after intense physical exercise. Please review the action steps and comments in relation to this result.

What does this MCT-1 genetic test result mean?

This Individual may experience muscle soreness since lactate is removed slowly from cells based on this MCT-1 genotype. MCT1 mediates the movement of lactate and pyruvate across the cell membrane.

ACTION STEPS and comments:

- Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.

eNOS genetic test result

Gene and SNP ID	Genotype	Indicator	Result and Interpretation
eNOS3 rs2070744	CT		**Mixed endurance and power athletic performance** since it has been shown that exercise improves muscle vasodilation response. Please review the action steps and comments in relation to this result.

What does this eNOS genetic test result mean?

This individual has inherited an eNOS3 profile reported to be associated with a mixed power athletic performance genotype. The power athletic performance was improved in individuals with this genotype participating in jumping, throwing and sprinting.

ACTION STEPS and comments:

- Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.

ACE haplotype genetic test result

Gene and SNP ID	Haplotype	Indicator	Result and Interpretation
ACE rs4341	CG		**HIGHER serum and ACE activity** giving the individual endurance and sprint ability. This result is classified as an Insertion/Deletion haplotype. Please review the action steps and comments in relation to this result.
ACE rs4343	AG		

What does this ACE haplotype genetic test result mean?

This individual has inherited the ACE insertion/deletion genotype which is associated with a mixed endurance and sprint performance genotype.

ACTION STEPS and comments:

- Specific training will assist the individual to develop an appropriate training regimen considering this genetic criterion to reduce the risk of injury.