dnadiet®

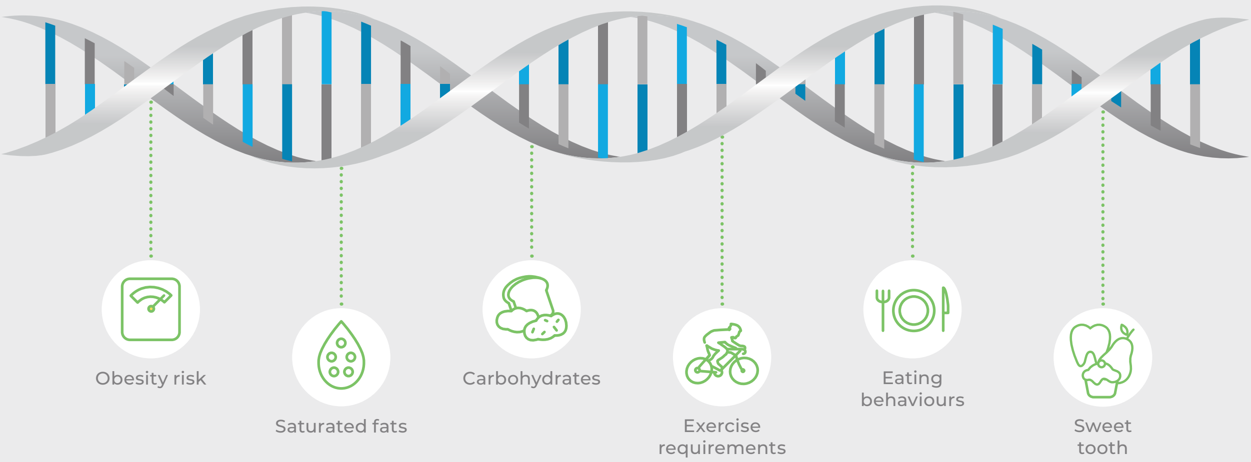
Welcome

Example

to your DNA Diet report

Date of birth:	Date reported: 20 Oct 2021	Sample number: DNAZA
Referring practitioner: Private Private		

DNA Diet is a genetic test that offers insight into key areas that influence weight, guiding diet and exercise recommendations for improved outcomes.



Genetics and personalised medicine

Genes are segments of DNA that contain the instructions your body needs to make each of the many thousands of proteins required for life. Each gene is comprised of thousands of combinations of "letters" (called bases) which make up your genetic code. The code gives the instructions to make the proteins required for proper development and function.

Genetic variations (small differences in our DNA) can affect the expression of a gene, thereby affecting metabolic processes that are important for maintaining cellular health and how we respond to environmental interventions such as diet, lifestyle, supplements, and medication. Knowledge of these genetic variations offers unparalleled insight into your biological systems, allowing your healthcare practitioner to recommend precise interventions aimed at helping you reach your goals and achieve optimal health.

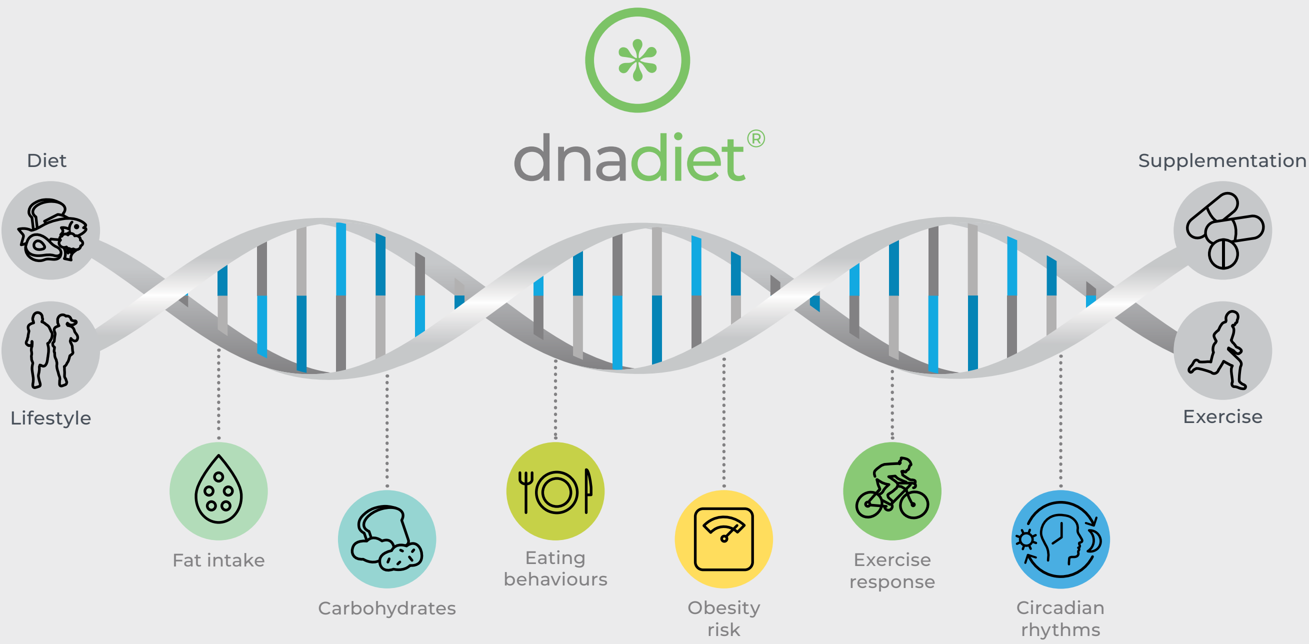
NORMAL GENE
Genotype resulting in baseline response to weight management interventions

VARIANT GENE
Genotype resulting in altered response to weight management intervention and need for personalisation

Personalised medicine and weight management

Overweight and obesity is strongly related to risk for development of chronic diseases, from heart disease to type 2 diabetes and even certain cancers; however, the contributing factors toward obesity are extremely complex and weight management requires a multifaceted approach.

Precision nutrition is an emerging therapeutic approach that takes into account an individual's unique genetic code, as well as age, sex, and particular pathophysiological status. Personalised recommendations using this holistic approach to weight loss is essential to improve outcomes. This report provides you with valuable insights into individual priority areas that should be considered for successful and sustained weight management outcomes.

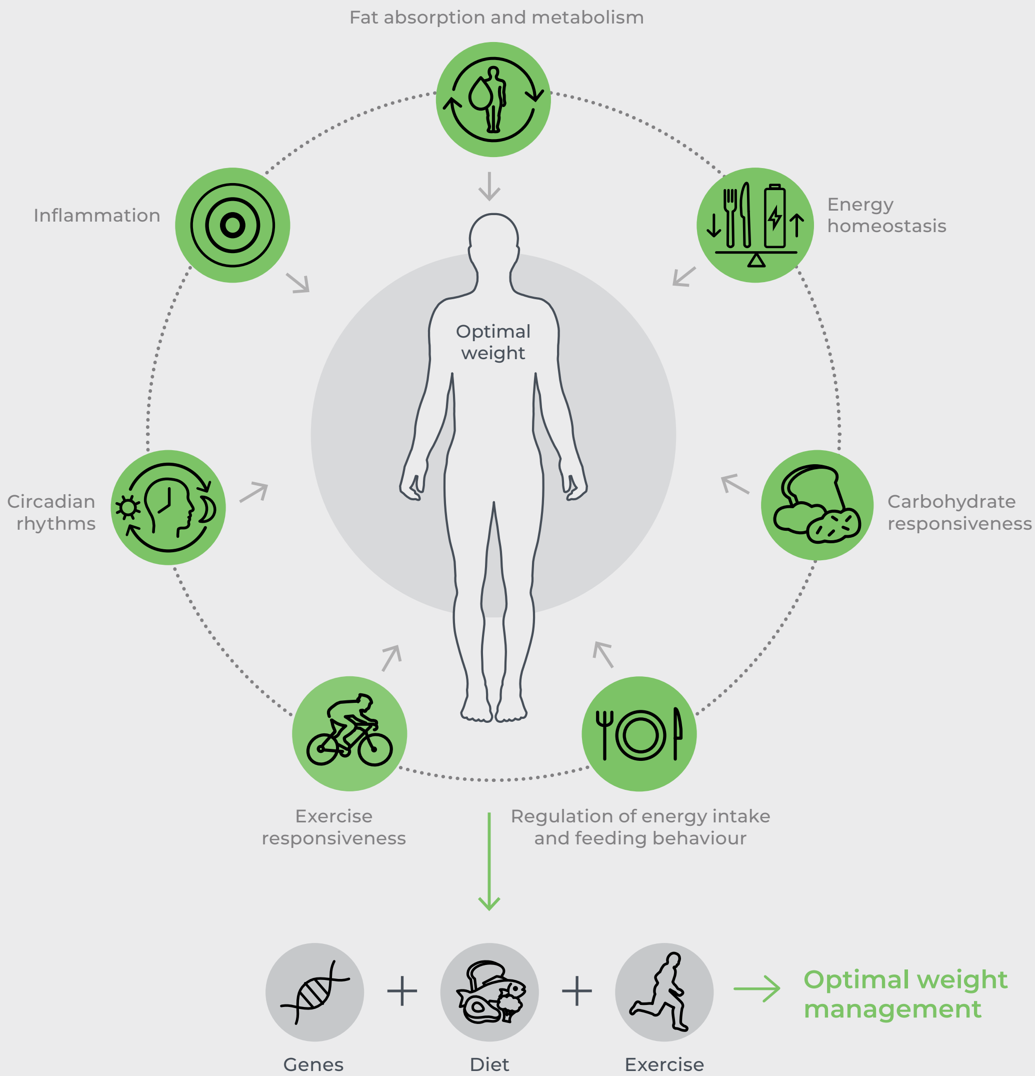


Understanding weight management

The majority (90% to 95%) of overweight and obesity is polygenic and multifactorial in nature. This means that whilst an individual's susceptibility to becoming overweight/obese has a strong genetic contribution, many other factors also play a significant role, including environmental exposure to toxins and stress, gut health, hormonal health and age, exercise behaviour, and dietary intake. Therefore, both genes and environment should be considered to better understand the mechanisms behind becoming overweight/obese.

There is substantial evidence to show that variants in genes associated with weight management are involved in different biological pathways, including the central nervous system, food sensing and digestion, adipocyte differentiation, insulin signalling, lipid metabolism, muscle and liver biology, and gut microbiota. A growing body of research suggests changes in adiposity and metabolic response to low calorie diets may be modified by genetic variants related to obesity, metabolic status, and nutrient preferences.
This knowledge further supports the implementation of a holistic and personalised approach to weight management, taking into account an individual's unique genetic code and how he/she would respond to dietary, lifestyle and exercise interventions, thus improving motivation, compliance, and sustainable weight management outcomes.

DNA DIET PROVIDES INSIGHTS INTO KEY AREAS FOR IMPROVED AND SUSTAINABLE WEIGHT LOSS OUTCOMES



Result summary

Outcome: Diet type

Based on our analysis of your genes, we recommend a MEDITERRANEAN DIET plan as the best possible diet for you to manage your weight.

Outcome: Exercise requirements

A programme that includes 20 MET HOURS a week

Outcomes: Priority areas

CATEGORY	IMPACT
Obesity risk	LOW-MODERATE
Exercise importance	LOW-MODERATE
Carbohydrates as a barrier	LOW-MODERATE
Saturated fat as a barrier	LOW-MODERATE
Monounsaturated fat as a benefit	LOW
Polyunsaturated fat as a benefit	MODERATE
Sweet tooth	MODERATE
Snacking and satiety	LOW
Circadian rhythms	MODERATE

Summary recommendations

Based on your priority area outcomes, we have provided summary recommendations for the key area's you should be focusing on for optimal weight management.

PRIORITY AREA	WHAT IS IT?	WHAT SHOULD I DO?
Polyunsaturated fat (PUFA)	Certain gene variations have been associated with improved weight management outcomes when there is a higher intake of PUFAs in the diet, with a focus on omega 3 fatty acids, and the total saturated fat intake is limited.	Your genes show that you may have a beneficial response with weight management when you increase your total PUFA intake and there is a higher ratio of PUFA:SFA (saturated fatty acids) in the diet. Good quality PUFA sources include a variety of nuts and seeds, nutbutters, and fatty fish.
Sweet tooth	Having a "sweet tooth" can be described as craving, or seeking out, sweet foods. This has been linked to an increased risk for being overweight/obese.	Your genotype combination influences your ability to taste sweet foods, and may contribute toward you having a "sweet tooth". It is important to try to completely avoid all high-sugar foods such as sweets, pastries, cakes and sweetened beverages. It would also be prudent to avoid artificially sweetened foods and drinks to help sensitise your 'sweet' taste buds.
Circadian rhythms	The CLOCK gene helps regulate your day-night cycle & influences evening preference. Sleep reduction, changes in ghrelin values, altered eating behaviours & evening preference may have a negative effect on weight management.	Your genotype may increase susceptibility for having an evening preference. This variant is linked with increased snacking behaviour and a more sluggish metabolism in the evenings, as well as staying up later. Adopt sleep hygiene principles (avoid any screen time 2 hours before bed, sleep in a dark room), and opt for your main meal earlier in the day.

Genotype results

○ No Impact ● Low Impact ●● Moderate Impact ●●● High Impact

BIOLOGICAL AREA	GENE NAME	GENE VARIATION	RESULT	GENE IMPACT
Fat absorption and metabolism	ADIPOQ	-11391 G>A	GG	●●
	ADRB2	Arg16Gly	GG	●●
	APOA2	-256 T>C	CT	●
	APOA5	-1131 T>C	TT	●●
	FABP2	Ala54Thr	GG	○
	PPARG	Pro12Ala	CC	○
	PLIN	11482 G>A	GG	○
Energy homeostasis	UCP1	-3826 A>G	GG	●●
	UCP2	-866 G>A	GA	○
	UCP3	55 C>T	CC	○
Carbohydrate responsiveness	ADRB2	Gln27Glu	CG	●●
	DRD2	rs1800497 C>T	CC	○
	SLC2A2	Thr110Ile	CC	○
	TAS1R2	Ile191Val	GA	●●
Regulation of energy intake and feeding behaviour	FTO	rs9939609	AT	●●
	MC4R	V103I	TT	○
	TCF7L2	rs7903146	CC	○
Exercise responsiveness	ADRB3	Trp64Arg	TT	○
Circadian rhythms	CLOCK	3111 T>C	TC	●
Inflammation	TNFA	-308 G>A	AG	●

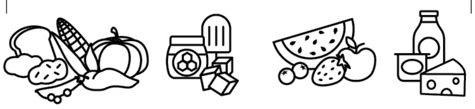
Your diet plan

Mediterranean Diet

The Mediterranean food patterns are typical of Crete, Greece and Southern Italy in the early 1960's. The term is closely tied to traditional areas of olive cultivation in the Mediterranean region more than 30 years ago, and not to the urbanized diet eaten in these countries today. Several studies have established the health benefits of the Mediterranean Diet in reducing the risk of metabolic syndrome, type 2 diabetes, cardiovascular disease, and some neuro-degenerative diseases and cancers. In addition, it has been shown to be an extremely effective eating plan for weight loss.

WHAT IS A CARBOHYDRATE?

CARBOHYDRATES



STARCH	SUGAR	FRUIT	DAIRY
Bread, potato, rice, couscous Corn, peas, sweet potato, butternut & pumpkin	Honey, white & brown sugar, sweets	Apples, pears, berries, melon, peaches	Yoghurt, milk

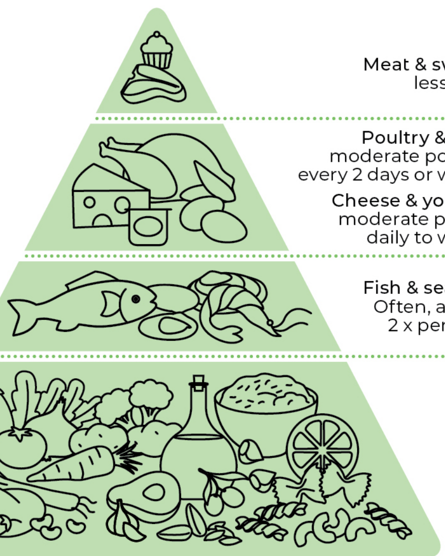
WHAT IS A FAT?

FATS

UNSATURATED FAT		SATURATED FAT	TRANS FAT
MONO-UNSATURATED FAT		Full cream dairy, butter & lard, fat on meat, chicken skin	Deep fried foods, commercially baked goods
Olive oil, avocado			
POLY-UNSATURATED FAT			
OMEGA 3	OMEGA 6		
Oily fish, flaxseed oil	Sunflower oil, sesame seeds		

FOOD GUIDE PYRAMID

• Drink water



Meat & sweets: less often

Poultry & eggs: moderate portions every 2 days or weekly

Cheese & yoghurt: moderate portion daily to weekly

Fish & seafood: Often, at least 2 x per week

Base every meal on: fruits, vegetables, grains (mostly whole), olive oil, beans, nuts, legumes and seeds, herbs & spices

THE DIET IS BEST DESCRIBED AS:

- Rich in plant foods (whole-grain cereals, fruits, vegetables, legumes, tree nuts, seeds and olives).
- Extra virgin olive oil is the principle source of added fat.
- High to moderate intakes of fish and seafood.
- Moderate consumption of eggs, poultry and low fat dairy products (mainly cheese and yoghurt).
- Low consumption of red meat.
- Moderate intake of alcohol (mainly wine during meals).
- In addition all foods in this plan should be as fresh as possible, minimally processed, and local and seasonal foodstuff should be used.

Your exercise plan

By now you will know the amount of exercise we recommend you do per week to maximise your chance of weight loss. This recommendation would have been given as MET HOURS. Below you will find a detailed explanation of exactly what MET HOURS are, and a guide to plan your exercise week to meet your recommended MET HOURS. Remember to consult your physician before embarking on a new exercise programme, and to stop exercising if you feel nauseous or short of breath.

What is a MET?

MET stands for Metabolic Equivalent Task. METs are a **way to measure how much energy you burn up during any chosen physical activity**. Every activity, from watching TV to going for a run, has a MET value. The more vigorous the activity, the higher the MET value.

What are MET HOURS?

Whereas METs are a way to measure the intensity of a particular activity, MET HOURS **allow you to calculate how many hours of your chosen activities you need to do** in a week.

Three easy steps to calculating your weekly MET HOURS score

Refer to your exercise requirements on page 4, and to the the table of activities divided into light, moderate and vigorous intensity on page 9.

1. **Match your activity of choice to the exercise description** to determine whether you are reaching your recommended amount of physical activity in MET HOURS. Try to balance high intensity sessions with light to moderate exercises to assist with recovery and decrease risk of injury and ‘burning out’.

2. **Use this equation to calculate the MET HOURS for each activity:**

   MET VALUE x DURATION = MET HOURS SCORE (in hours)

   For example, if you play singles tennis for 1 hour and 40 minutes (1.60 hours):
   8 METS x 1.60 = 13 MET HOURS

3. **To calculate your weekly MET HOURS SCORE:**

   Add the MET HOURS SCORE of each workout for that week

   For example, if you played singles tennis for 1 hour and 40 minutes, ran for 30 minutes at a pace of 8 km/hour (8 x 0.5 = 4) and played 2 hours of golf (4.5 x 2 = 9), then your weekly MET HOURS SCORE will be 26 (13 + 4 + 9)

Table of activities:

Exercise intensity for 1 hour of excercise:

0 — LIGHT — LESS THAN 5 METS

5 — MODERATE — 5-9 METS

9 — HIGH — 9 METS AND ABOVE

EXERCISE DESCRIPTION	METS
Walking, 3.2km/hr, firm, flat ground	2.5
Cycling, less than 16km/hr, for leisure	3.4
Walking, 5.6km/hr, brisk pace, firm surface	3.8
Rowing, stationary, 50 watts, light effort	4
Water aerobics	4
Golf	4.5

EXERCISE DESCRIPTION	METS
Cycling, stationary, 100 watts, light effort	5.5
Boxing, punching bag	6
Cycling, stationary, 150 watts	7
Aerobics, high impact	7
Swimming, freestyle, moderate	7
Circuit training	8
Running, 8km/hr	8
Mountain biking	8.5
Stationary rowing, 150 watts	8.5

EXERCISE DESCRIPTION	METS
Stairmaster	9
Cycling, 22-26km/hr, vigorous	10
Running, 9.6km/hr	10
Swimming, treading water, fast	10
Stationary rowing, 200 watts, very vigorous	12
Rope jumping, fast	12
Squash	12

Talking during exercise is a reliable way to measure your exercise intensity:

- If you can talk without puffing at all, you're not pushing too hard and it's very likely a **light intensity** activity.
- If you can talk but not sing, you're exercising at a **moderate intensity**.
- If you can't talk without gasping, then you are exercising at a **high intensity**.

Area of activity and gene descriptions

Fat absorption and metabolism

This area of activity includes genes that are involved in absorption of dietary fat through to those genes that influence the transport of lipids in various forms, and the metabolism of fat as an energy source. The gene variants reported here contribute towards the priority areas of obesity risk, fat intake and weight loss response as well as exercise requirements.

ADIPOQ -11391 G>A

ADIPOQ encodes adiponectin, which is expressed in adipose tissue. Adiponectin is a protein hormone that modulates a number of metabolic processes, including glucose regulation and fatty acid oxidation. Obese subjects tend to have lower circulating levels of adiponectin. Individuals with the A allele tend to have higher levels of adiponectin and have been associated with improved obesity parameters. A allele carriers who consumed a diet that comprised more than 13% of total energy from mono-unsaturated fats had a lower BMI. Generally, G allele carriers have increased risk for obesity. GG genotype individuals better manage weight on a calorie-restricted diet. Continued follow-up and support is required.

ADRB2 Arg16Gly G>A

ADRB2 encodes for the adrenergic B receptor, which is involved in the mobilisation of fat from fat cells for energy in response to catecholamines and modulates lipolysis during exercise. The G allele has been associated with obesity, and G allele carriers are more likely to gain and regain weight and lose weight more slowly. These carriers are less able to mobilize fat stores in response to exercise. In these individuals it is important to emphasize diet for weight management as exercise may be less effective.

APOA2 265 T>C

Apolipoprotein A2 (APOA2), the second most abundant apolipoprotein in HDL, plays a complex and relatively undefined role in lipoprotein metabolism, insulin resistance, obesity, and atherosclerosis susceptibility. The CC genotype is associated with obesity and increased food consumption, especially total fat and saturated fat intake. When saturated fat intake is high the CC genotype is strongly associated with increased BMI and obesity. This diet-gene interaction may also play a role in insulin resistance (IR).

APOA5 1131 T>C

APOA5, encoding apolipoprotein A5, is involved in triglyceride metabolism and has strong interactions with influencing BMI. The T allele has been associated with greater weight and less weight loss, especially when on a high fat, high saturated fat diet.

FABP2 Ala54Thr G>A

Fatty acid binding protein 2 (FABP2) protein is found in the small intestine epithelial cells where it strongly influences fat absorption and metabolism. The A allele is associated with obesity, elevated BMI, increased abdominal fat, higher leptin levels, insulin resistance, higher insulin levels, and hypertriglyceridemia. A allele carriers have greater fat absorption and tend to have a slower metabolism, leading to a tendency for weight gain, slower weight loss and difficulty in losing abdominal fat. These individuals are advised to reduce saturated fat intake.

PLIN 11482 G>A

PLIN encodes for perilipin, also known as lipid droplet-associated protein, and associates with the surface of lipid droplets. Phosphorylation of perilipin is essential for the mobilization of fats in adipose tissue. A allele carriers are more weight loss resistant and show greater decrease in lipid oxidation rate than GG. When there is a higher intake of complex carbohydrates, the A allele shows protection against obesity. Avoid all refined carbohydrates.

PPARG Pro12Ala C>G

This protein is abundantly expressed in fat cells. It is a transcription factor activated by fatty acids and plays an important role in the expression of adipocyte-specific genes. The CG and GG genotypes are associated with increased risk for obesity, especially when exposed to an obesogenic environment. A sedentary lifestyle also contributes toward obesity risk in G allele carriers. To better manage weight, increase physical activity levels and implement a calorie restricted, controlled eating plan.

Energy homeostasis

This biological process involves the coordinated regulation of food intake and energy expenditure. The gene variants reported in this area strongly influence metabolic rate and contribute towards the priority areas of obesity risk as well as exercise requirements.

UCP's

The uncoupling proteins 1, 2 and 3 belong to the family of mitochondrial transporter proteins that allow protons to re-enter the mitochondrial matrix without phosphorylating ADP (adenosine diphosphate), thus uncoupling the connection between oxidative metabolism and energy production, releasing energy as heat. The uncoupling proteins may therefore play an important role in energy homeostasis. These proteins share structural similarities but are expressed in different tissues.

UCP1 -3826 A>G

Due to the possible weight loss resistance that G allele individuals may face, it is important to set realistic weight management goals, and focus on interventions that will improve the individual's ability to burn fat. Include more high intensity exercise, or interval training, in the weight management plan. Regular follow up and practitioner support will also help to improve weight management outcomes.

UCP2 -866 G>A

The A allele may offer protection against a higher BMI. It has been shown that by following a hypocaloric diet, UCP2 and UCP3 expression can be significantly increased in adipose and skeletal muscle cells. G allele carriers would therefore benefit from restricting total energy intake long-term, and engaging in regular physical activity.

UCP3 55 C>T

The T allele offers protection against a higher BMI. It has been shown that by following a hypocaloric diet, UCP2 and UCP3 expression can be significantly increased in adipose and skeletal muscle cells. C allele carriers would therefore benefit from restricting total energy intake.

Carbohydrate responsiveness

The genes reported in this area are involved in possible barriers to weight loss in response to carbohydrate intake. It is important to note that both the quantity and quality of carbohydrates may influence weight management outcomes. The gene variants contribute toward the priority areas of obesity risk, carbohydrate responsiveness, sweet tooth, and exercise requirements.

ADBR2 Gln27Glu C>G

The G allele has been associated with increased BMI and fat mass. Subjects with the CG and GG genotypes are less able to mobilise fat stores for energy and have been shown to have a greater risk of obesity and elevated insulin levels when carbohydrate intake is greater than 49%. Decreasing intake of carbohydrates has been shown to reduce insulin levels and is beneficial to weight management.

DRD2 C>T

DRD2 encodes for the dopamine receptor 2, which plays a major role in feelings of reward and eating behaviour. Foods rich in carbohydrates increase dopamine levels and this variant in the DRD2 gene has been linked to binge eating behaviour especially for carbohydrate-rich foods. Carriers of the T variant should be mindful of maintaining stable blood sugar levels, avoiding 'trigger foods' and limiting total carbohydrate intake, especially those from refined sources and sugar.

SLC2A2 Thr110Ile C>T

GLUT2, coded by the SLC2A2 gene, is a member of the facilitative glucose transport protein (GLUT) family and facilitates the first step in glucose induced insulin secretion, with the entry of glucose into the pancreatic βcell. Carriers of the T risk variant display an increased disposition to seeking out sweet foods and refined carbohydrates. Be mindful of maintaining stable blood sugar levels, and limit total carbohydrate intake, focusing only on low glycaemic index (GI) options.

TAS1R2 Ile191Val A>G

TAS1R2 gene encodes the sweet taste receptor, which affects food intake beyond the detection of sweet taste on the tongue and palate. Carriers of the A allele may be predisposed to having a 'sweet tooth' and seek out sweet and refined carbohydrate-rich foods more frequently, increasing susceptibility to being overweight. These individuals should avoid all processed sugar foods and sweetened beverages.

Regulation of energy intake and feeding behaviour

There is significant evidence to motivate that snacking and eating behaviour is highly heritable, which means that gene variants that you carry may increase your predisposition toward increased feelings of hunger and having a greater appetite, thus hindering weight loss. The good news is that the expression of these genes can be modified by taking action with personalised diet, lifestyle and exercise recommendations. The gene variants in this area contribute toward the priority areas of obesity risk, snacking behaviour, fat intake and weight loss response, as well as exercise requirements.

FTO T>A

The Fat-mass-and-obesity-associated (FTO) gene is present at high levels in several metabolically active tissues that regulate arousal, appetite, temperature, autonomic function, and endocrine systems. FTO plays a role in appetite regulation, and it is associated with energy expenditure, energy intake, and diminished satiety. The A allele has been associated with higher BMI, body fat percentage and waist circumference, especially in individuals with a sedentary lifestyle and a high fat intake. Modify the diet of A allele carriers to include a moderate amount of carbohydrate, increase monounsaturated fatty acid (MUFA) intake and decrease saturated fat. Regular physical activity is recommended.

MC4R T>C

MC4R is a strong obesity candidate gene significantly associated with energy intake and expenditure. The C allele is associated with higher intakes of total energy and dietary fat, as well as greater snacking in children and adults, greater hunger, and a higher prevalence of eating large amounts of food. Compliance with the Mediterranean style diet has been shown to yield better weight management results in C allele carriers. Increase intake of fibre-rich foods, do not skip meals, and implement mindful eating practices.

TCF7L2 rs7903146 C>T

Transcription factor 7-like 2 (TCF7L2) gene encodes a transcription factor that regulates blood glucose homeostasis and may operate via impaired glucagon-like peptide 1 secretion, which is stimulated more by fat than by carbohydrate ingestion. Individuals with the T allele, and more so the TT genotype, experience less weight loss than those with the CC genotype. Diet and exercise intervention is very important for T allele carriers to prevent weight regain and development of insulin resistance. T allele carriers lose more weight on a low fat, hypo-energetic diet compared to a high fat diet. A low glycaemic load (GL) diet and all interventions to manage insulin sensitivity are also recommended.

Exercise responsiveness

Increasing activity levels is a key component to a successful weight management outcome, however research suggests that some individuals require much higher levels of physical activity to mobilise fat stores, and the intensity and frequency of exercise becomes more important as a focus area to improve metabolic rate and achieve sustained weight loss. ADRB3 described below, together with other genes analysed in DNA Diet, contribute toward the priority areas of obesity risk and exercise requirements.

ADRB3 Trp64Arg T>C

The beta-3 adrenergic receptor (ADRB3) protein is expressed primarily in visceral adipose tissue where it is involved in the regulation of lipolysis. The C allele is associated with increased BMI and weight loss resistance. The higher risk of obesity among carriers of the C allele may be diminished by above average levels of vigorous physical activity.

Circadian rhythms

Your day-night cycle (i.e. when you are awake and when you go to and how well you sleep) plays a major role in regulating hormone levels such as insulin and cortisol, appetite control, weight management and overall health. Your genes plus your environment determine your unique circadian rhythm. The genetic variant reported in this area contributes toward the priority areas of obesity risk and carbohydrate responsiveness.

CLOCK 3111 T>C

Circadian Locomotor Output Cycles Kaput (CLOCK), an essential element of the human biological clock, is involved in metabolic regulation. Carriers of the C allele are less successful losing weight than the TT genotype. In addition, those with the C allele have reduced sleep, report morning fatigue and show an evening preference for activities, they also have higher ghrelin levels which regulates appetite, potentially altering eating behaviour and weight loss. These individuals should prioritize a healthy sleep routine.

Inflammation

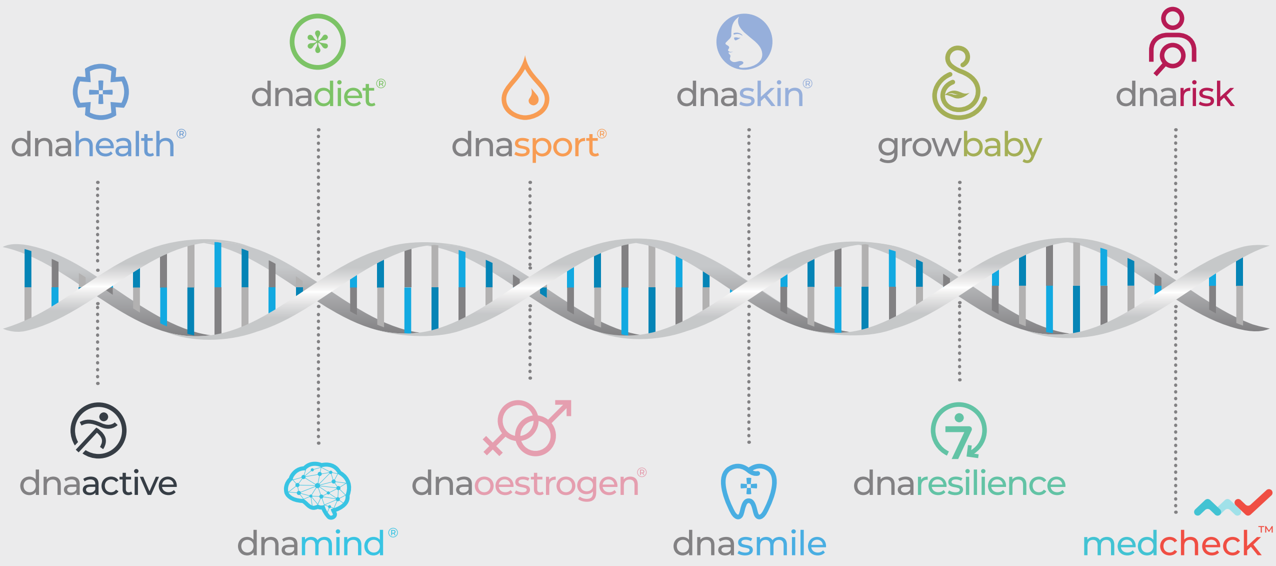
Inflammation is an essential process in our body that helps with the normal functioning of the immune system, however when exposures to the contributors of inflammation is prolonged, such as with a Modern Western diet, high sugar intake and high stress levels, inflammation can become chronic. Weight gain has been linked with higher levels of inflammatory markers, and high inflammatory markers have been associated with poor weight loss outcomes. It is thus essential to control inflammation to achieve weight management goals. The genetic variant reported in this area contributes toward the priority areas of obesity risk and fat responsiveness.

TNFA -308 G>A

Tumour necrosis factor-α (TNF α), a proinflammatory cytokine secreted by immune and fat cells and has been implicated in the development of obesity and insulin resistance. The A allele increases TNFα production and is associated with increased obesity risk especially when dietary fat intake is high. Weight management is imperative in managing inflammation.

A lifetime of optimal health awaits you

Your genes do not change, which means our laboratories will only ever need one cheek swab sample from you. Throughout your life, as your health goals and priorities change, we can continue to provide valuable health insights from this single cheek swab to support your unique health journey.



Our Commitment

DNAlysis Biotechnology is continuously developing new tests with the highest standards of scientific rigour. Our commitment to ensuring the ethical and appropriate use of genetic tests in practice means that gene variants are only included in panels once there is sound motivation for their clinical utility and their impact on health outcomes.

ADVANCED technology | ACTIONABLE interventions | APPROPRIATE use in practice

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Risks and Limitations:
DNAlysis Biotechnology has a laboratory with standard and effective procedures in place for handling samples and effective protocols in place to protect against technical and operational problems. However as with all laboratories, laboratory error can occur; examples include, but are not limited to, sample or DNA mislabelling or contamination, failure to obtain an interpretable report, or other operational laboratory errors. Occasionally due to circumstances beyond DNAlysis Biotechnology's control it may not be possible to obtain SNP specific results.