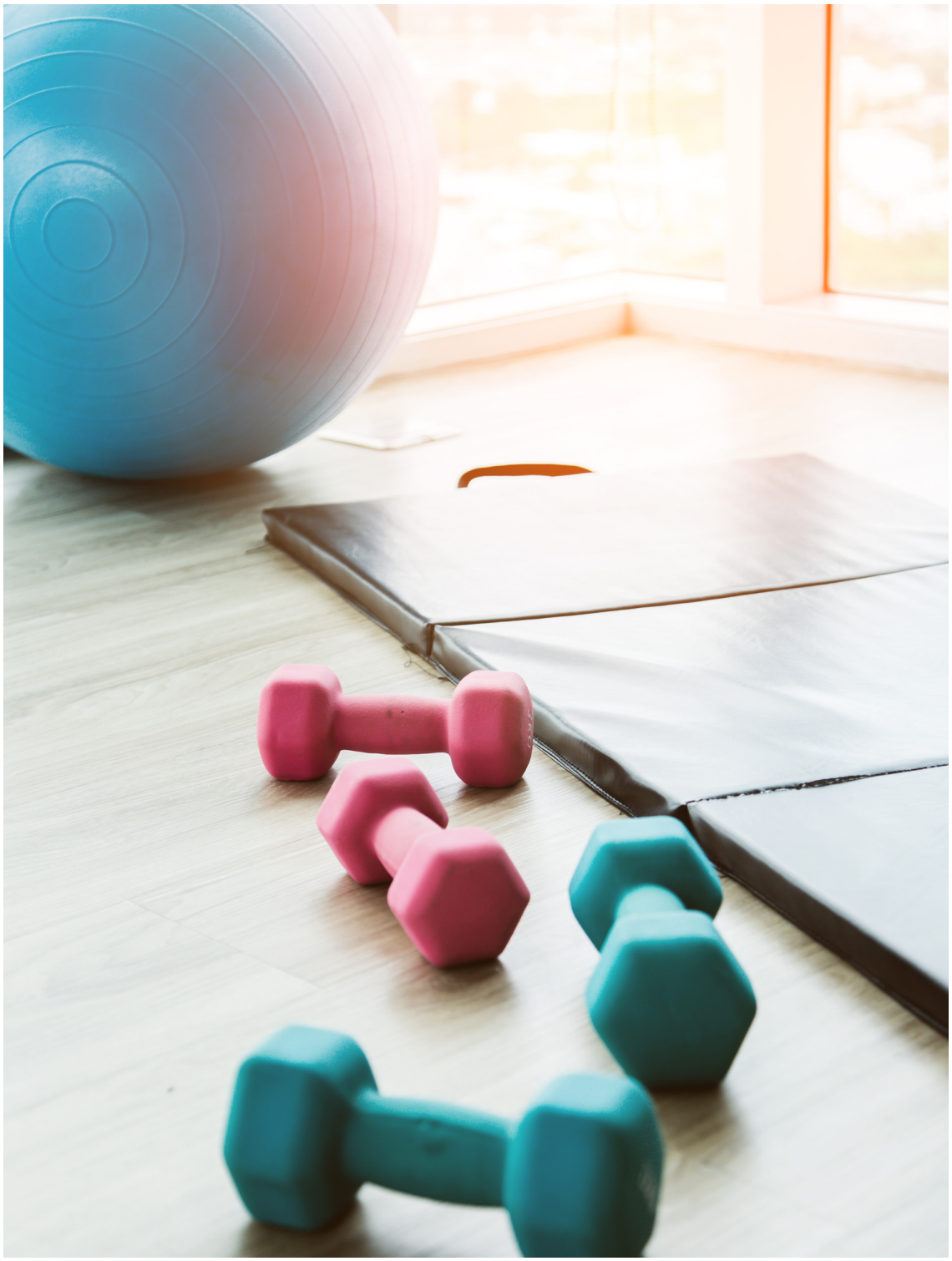

INTRODUCTION

Your personalized fitness report is all about helping you reach your fitness goals! This clear and simple report gives you an in-depth look at your genetic predisposition to certain types of fitness and how your body reacts to them. It also provides information on your likelihood of experiencing certain sports-related injuries. By working with a personal trainer, you can use this information to create a custom training plan that is tailored to your unique genetic makeup. Understanding your DNA variations can be a powerful tool in helping you reach your physical fitness goals. Remember, this report is just one piece of the puzzle when it comes to reaching your fitness goals. It's important to have a conversation with your personal trainer to make sure you're on the right track.

For more information, visit our website at https://www.dantelabs.com/ and check out our FAQs for all your questions.

LIMITATIONS AND OTHER IMPORTANT INFORMATION

- This test provides genetic risk information based on assessment of specific genetic variants within your DNA but does not report on your entire genetic profile. This test does not report all genetic variants related to a given disease or condition, and the absence of a variant tested does not rule out the presence of other genetic variants that may be related to the disease/condition.
- This test does not provide INDEL (INsertions/DELetions) mutation analysis. Mutations analyzed include SNPs (Single Nucleotide Polymorphisms). Other genetic risk tests may report different genetic variants for the same disease/condition, so you may get different results using another genetic risk test.
- Other factors such as environmental and lifestyle risk factors may affect your risk of developing a given disease or health condition.
- This test is not a substitute for visits to your doctor or other healthcare professional. You should consult with your doctoror other healthcare professional if you have any questions or concerns about the results of your test or your current state of health. You may wish to speak to a genetic counselor, board-certified clinical molecular geneticist, or equivalent healthcare professional about the results of your test and to help answer any questions you may have. You can identify genetic counselors by visiting the National Society of Genetic Counselors website (https://www.nsgc.org).
- This test is not intended to diagnose a disease or condition, tell you about your current state of health, or be used to make medical decisions, including whether you should take a medication or how much of a medication you should take.
- The laboratory may not be able to process your saliva sample in certain instances. In this case Dante Genomics will offer to send another kit to you to collect a second sample at no charge. If Dante Genomics attempts to process the second sample are unsuccessful, Dante Genomics will initiate a full refund to the person who paid for the Service. For full Terms of Services, please visit: https://www.dantelabs.com/pages/terms-of-service
- This report has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent disease.

INFORMATION FOR HEALTH CARE PROFESSIONALS

This test is not intended to diagnose a disease, determine medical treatment, or tell the user about their current state of health. This test is intended to provide users with their genetic information to inform lifestyle decisions and conversations with their doctor or other healthcare professional. Any diagnostic or treatment decisions should be based on testing and/or other information that you determine to be appropriate for your patient.

QUICK SUMMARY

TRAINING

Genetic factors play a key role in the subjective predisposition towards a certain type of training and towards the body's response to sport in general. In fact, various physiological parameters can be modeled by sporting activity, such as blood pressure and respiratory capacity. Likewise, genetics drive athletes' performance characteristics, determining whether they are more predisposed to endurance or speed sports. Finally, exercise can positively affect the presence of genetic variants predisposing to overweight, especially if combined with a calorie restriction program planned by a nutrition expert.

CONDITION NAME	RESULTS	MAIN MESSAGE
Endurance workout	✓	Normal – No presence of genetic variants detected.
Physical activity in weight loss	⚑	Flagged – Regular exercise and an active lifestyle are highly recommended. Seeking expert advice on a customised diet and exercise plan is the best way to keep weight gain under control.
Blood pressure response to physical activity	✓	Normal – No presence of genetic variants detected.
Sprint	✓	Normal – No presence of genetic variants detected.
Prepared for speed sports	✓	Normal – No presence of genetic variants detected.
Pace and variability of gait	⚑	Flagged – It is recommended to reduce the frequency and pace of your workouts, thus making them more efficient. This will also consume less energy.
Athletic difficulties due to reduced heart rate	⚑	Flagged – It is advisable to monitor the heart rate, as it is possible to reach a heart rate of 35 - 40 bpm, which is the classic athlete's bradycardia.
Muscle response to resistance training	⚑	Flagged – It is advisable to include isometric exercises in your training plan with the aim of increasing muscle strength and tone, without increasing mass. In addition, to prevent injuries, it may be helpful to introduce additional strength and endurance training and flexibility exercises.
Respiratory capacity	✓	Normal – No presence of genetic variants detected.
Difficulty in losing weight	✓	Normal – No presence of genetic variants detected.

INJURIES

Injuries in sports are a fairly common occurrence and, in most cases, are due to excessive training (overtraining), which subjects muscles, tendons, ligaments and joints to intense stress. The most common injuries affect the muscles, tendon structures and bones, giving rise to consequences that can impose a stop in sports even for a long time. It is therefore advisable to learn to listen to your body, allow yourself the right recovery time and opt for the type of sport that best suits your inclinations and needs.

CONDITION NAME	RESULTS	MAIN MESSAGE
Rotator cuff disease		Flagged – Based on the genetic profile, it is highly recommended to focus part of the physical activities on exercises that aim to strengthen the shoulder muscles and improve joint flexibility.
Muscle cramps		Flagged – Based on your genetic profile, it is highly recommended to plan workouts with a personal trainer who is aware of your predisposition and prevent severe muscle cramps by including a comprehensive stretching program in your sports routine, both before and after each workout.
Predisposition to the development of inguinal stress hernias		Normal – No presence of genetic variants detected.
Risk of suffering muscle damage		Normal – No presence of genetic variants detected.
Stress fracture		Normal – No presence of genetic variants detected.
Propensity to the development of arthritic problems		Enhanced – It is recommended to reduce stress on joints by losing weight, which will improve mobility, decrease pain and prevent joint damage. Regular movement helps maintain joint flexibility, but there are exercises that can be harmful, such as running and walking. Instead, low-impact exercises such as water aerobics or swimming are preferred to flex the joints without adding additional stress.
Knee osteoarthritis		Normal – No presence of genetic variants detected.
Predisposition to epicondylitis (Tennis Elbow)		Normal – No presence of genetic variants detected.
Lumbar disc disease susceptibility		Flagged – A course of at least six weeks of physical therapy with an emphasis on core strengthening and stretching should be attempted. Non-surgical intervention includes cognitive therapy, lifestyle and activity modification that may exacerbate pain, non-steroidal anti-inflammatory drugs (NSAIDs) and epidural injections.
De Quervain's tenosynovitis		Normal – No presence of genetic variants detected.
Tendinopathy		Normal – No presence of genetic variants detected.

METABOLISM

The presence of certain polymorphisms in genes involved in metabolism can negatively affect the way we metabolize nutrients by predisposing, for example, to the accumulation of fat and to an altered sensitivity to insulin. Sport, in these cases, can mitigate the effects, contributing to the achievement of weight. In these cases, it is always advisable to contact a nutrition expert in order to optimize the possible results of a training program associated with a personalized nutritional plan.

CONDITION NAME	RESULTS	MAIN MESSAGE
Folate metabolism		Flagged – Compensate for low metabolism with a higher intake of green leafy vegetables, especially spinach. You can also consult an expert for guidance on how to supplement folic acid in your diet.
Glucose tolerance and lipid metabolism		Flagged – Reduce the intake of refined carbohydrates/simple sugars and saturated fats. Increase that of dietary fiber, monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). Increase aerobic physical activity.
Risk of overweight and obesity		Flagged – The intake of saturated fats should be limited, while mono and polyunsaturated fats should be increased. It is highly recommended to eat complex carbohydrates and low glycemic index foods. A combination of a Mediterranean diet and physical activity, with a controlled intake of calories, can favourably modulate the effects of the variants at risk.
Homeostasis of carbohydrates and lipids		Normal – No presence of genetic variants detected.
Risk of developing type 2 diabetes and insulin resistance		Normal – No presence of genetic variants detected.
Increased oxidative stress		Normal – No presence of genetic variants detected.

DIET

A correct intake of micronutrients is essential for the proper functioning of the organism, also and above all in sports, characterized by an increased nutritional requirement. Vitamins, while not providing energy to the body, are essential for an adequate energy metabolism and to counteract the increase in free radicals that are produced in aerobic activity. Finally, sports can help reduce the level of inflammation typical of some chronic diseases.

CONDITION NAME	RESULTS	MAIN MESSAGE
Tendency to hyperinflammation		Flagged – Follow an anti-inflammatory diet rich in fresh fruit and vegetables, aromatic herbs and spices, and good quality fats (prefer monounsaturated foods such as extra virgin olive oil and omega 3). Limit the consumption of simple sugars and keep blood sugar levels constant by eating low/medium glycemic index foods. Physical exercise of moderate intensity can increase the production of IL-6 in skeletal muscles. In this case, if the quantity is not excessive, the effects are beneficial for blood sugar and reducing fat deposits. However, an excess can have harmful effects. The intensity of physical activity must therefore be assessed in the case of the presence of SNP by a sports nutrition expert.
Retinol levels		Normal – No presence of genetic variants detected.
Vitamin B12 levels		Flagged – Measure the level of Vitamin B12 and take a test to verify the presence of H.pilory infection (breath test or stool analysis). If necessary, take a Vitamin B12 supplement after consulting a nutrition and health provider. Increase the intake of animal foods that are rich in vitamin B12 such as meat, fish, dairy, eggs or fortified foods.

KEY SUMMARY

The Summary provides an overview of the predicted risks for the patient. This information is based solely on genotype information and does not replace a doctor visit or a complete patient profile. Additionally, healthcare providers should consider family history, presenting symptoms, current prescriptions, and other factors before making any clinical or therapeutic decisions.

Normal – No presence of genetic variants detected.

We have found one or more genetic variants that provide an enhanced function.

We have identified one or more risk variants.

Endurance workout

RESULTS

Endurance training is aimed at increasing the ability to withstand prolonged physical exertion, without a drop in performance. Examples of this type of sporting activity (which largely engages the cardiovascular system) are, running, swimming and cycling. Sports performance is the result of the interaction between environmental, nutritional and biological factors such as carbohydrate/lipid metabolism, muscle strength, maximum oxygen absorption (VO2max), etc. Genetic factors also play an important role in the subjective predisposition towards a specific sporting activity and/or type of training. The HFE gene is involved in iron homeostasis and regulates the activity of key proteins involved in its absorption and circulation. Iron is an essential element for the synthesis of hemoglobin, the protein responsible for transporting oxygen to tissues. A specific variant of the HFE gene, rs1799945, interferes with its ability to limit the circulation of blood iron, resulting in an increase in this parameter. This effect is mediated by the G allele and, as endurance athletes require adequate iron levels for aerobic metabolism, carriers of the C/G or G/G genotype will benefit from the increase in blood iron to achieve higher VO2 max. This result can have a positive impact on endurance training, which requires great aerobic capacity.

Normal – No presence of genetic variants detected.

Physical activity in weight loss

RESULTS

Exercise is an important tool for weight control and generally maintaining a healthy lifestyle, as these factors are influenced by environmental factors and genetics. A physically active lifestyle can partly mitigate a genetic predisposition to obesity. This predisposition is induced by variation in a gene and is strongly associated with an increase in BMI (body mass index) of and WC (waist circumference). The gene in question is FTO, which is recognized as an important locus that possesses common variants with an undoubted impact on obesity predisposition and fat mass. The variant in question is rs1121980 with the T risk allele. If the individual has the genetic risk variant, exercise is strongly recommended. For those who do not have this variant, the risk factor is lower, but exercise is still strongly recommended, as this does not exclude the need to have an active lifestyle even if the genetic make-up is not of risk.

Flagged – Regular exercise and an active lifestyle are highly recommended. Seeking expert advice on a customised diet and exercise plan is the best way to keep weight gain under control.

VARIANTS FOUND

Gene	rsID	Genotype	Message
FTO	rs1121980	AA	Regular exercise and an active lifestyle are highly recommended. Seeking expert advice on a customised diet and exercise plan is the best way to keep weight gain under control.

Blood pressure response to physical activity

RESULTS

Arterial hypertension, or simply hypertension, is a common condition in which blood in the arteries circulates with high pressure. This is determined by the amount of blood pumped by the heart and the resistance of the arteries to the blood current. This condition affects both sexes, with a higher frequency in women after menopause, and it has been estimated that most people will develop this condition as they age. The EDN1 gene is the gene coding for endothelin 1, which is a potent vasoconstrictor and consequently a regulator of blood pressure. The EDN1 gene can have a variant, rs5370 with the T allele, whereby blood pressure is not regulated as it should be and increases the likelihood of suffering from hypertension. This has been shown especially in subjects with a low level of cardiorespiratory fitness, or the ability of the heart and lungs to supply the muscles with oxygen for physical activity. Conversely, this variant has no effect on those with a high level of physical activity and more specifically cardiorespiratory fitness. In the presence of the variant, exercise is strongly recommended in order to reduce the likelihood of developing the hypertension condition. It is emphasised that even in the absence of the variant, exercise remains recommended, as it is the best way to manage other possible risk factors for blood pressure and health in general.

Normal – No presence of genetic variants detected.

Sprint

RESULTS

The term 'sprint' indicates a quick and sudden shot aimed at reaching a goal. Since it is a physical effort that requires a lot of energy and an adequate supply of oxygen to the tissues, the possession of certain genetic variants involving genes involved in angiogenesis and erythropoiesis (respectively, the formation of new blood vessels and new blood cells rossi) can confer a biological advantage in speed performance. The EPAS1 gene is activated in conditions of hypoxia, that is, with a low concentration of oxygen in the tissues. In physiological conditions, therefore, it is degraded. On the other hand, when the oxygen level falls, this gene intervenes to restore an adequate supply of this element to the tissues. The EPAS1 gene variant rs1867785 has been found more frequently in sprint/power athletes, and the allele that confers an advantage in sprinting is G. This finding suggests that possession of the G/A or G/G genotype may contribute to sprint/power athletic performance, by intervening in the functions of the EPAS1 gene.

Normal – No presence of genetic variants detected.

Prepared for speed sports

RESULTS

Physical performance is influenced by several factors, including genetics. Nitric oxide (NO) is an important vasodilating molecule, i.e., it dilates blood vessels resulting in increased blood flow to the tissues, which then have a supply of oxygen and other nutrients. It improves muscle contraction function, helps modulate muscle tone, increases metabolism, helps modulate insulin secretion, stimulates strength, regulates respiration and keeps blood flow under control. NO production is catalyzed by a family of enzymes (NOS) whose formation is encoded by the corresponding NOS3 gene. This gene may have a variant, rs2070744. Individuals with a C/T or T/T genotype for this variant tend to have a higher rate and longer duration of activity, as the allele increases the activity of the gene promoter, thereby increasing NO synthesis.

Normal – No presence of genetic variants detected.

Pace and variability of gait

RESULTS

Gait is the set of rhythmic movements through which humans and animals move. The rhythm and frequency of gait are determined not only by environmental factors, but also by genetics. Gait is an important indicator of health, and its rhythm has been shown to be a highly heritable parameter. Certain genes play a role in this as they regulate cardiovascular and neuronal functions and determine smooth muscle tone. One of these genes is PRKG1 whose variant rs10823991, with genotype A/T or T/T, gives individuals possessing it a propensity to walk at a faster pace. Conversely, those with an A/A genotype will tend to walk at a slower, steadier pace.

Flagged – It is recommended to reduce the frequency and pace of your workouts, thus making them more efficient. This will also consume less energy.

VARIANTS FOUND

Gene	rsID	Genotype	Message
PRKG1	rs10823991	TT	It is recommended to reduce the frequency and pace, thus making them more efficient. This will also consume less energy.

Athletic difficulties due to reduced heart rate

RESULTS

Heart rate (HR) is the rate of heart contractions or pulsations measured by the number of beats per minute. Activities that can cause it to vary include exercise, sleep, anxiety, stress, illness and taking medication. M2 muscarinic receptors, which are found in the heart, act to slow the heart rate down to normal sinus rhythm after positive stimulation of the parasympathetic nervous system, slowing the rate of depolarization. Genetics plays a role in the athletic difficulties and recovery times an individual may have. The CHRM2 gene can present the rs324640 variant whereby C/C homozygous individuals showed a lower heart rate recovery after exercise than C/T heterozygous or T/T individuals (by 6 and 12 beats/min respectively). This was demonstrated especially regarding endurance training.

Flagged – It is advisable to monitor the heart rate, as it is possible to reach a heart rate of 35 - 40 bpm, which is the classic athlete's bradycardia.

VARIANTS FOUND

Gene	rsID	Genotype	Message
CHRM2	rs324640	AA	It is advisable to monitor the heart rate, as it is possible to reach a heart rate of 35 - 40 bpm, which is the classic athlete's bradycardia.

Muscle response to resistance training

RESULTS

Muscular endurance is the ability of a muscle to produce force over a certain period, in other words, to make muscle tension last. It depends on various factors such as gender, age, nutrition and genetics. Regarding the latter, there is a gene that influences the condition. The gene for the glucocorticoid receptor NR3C1 encodes for a protein that binds glucocorticoid hormones within the liver, muscles and vasculature and influences metabolism and cardiovascular function. Variants in this gene can affect these physiological systems and responses and can cause rapid cortisol binding resulting in increased body mass index, and decreased muscle size and strength, all of which translate into reduced resistance to exercise. Individuals with the C/T or T/T genotype for the rs4634384 variant of the above gene have been shown to have a lower muscular response to resistance training than individuals with the C/C genotype.

Flagged – It is advisable to include isometric exercises in your training plan with the aim of increasing muscle strength and tone, without increasing mass. In addition, to prevent injuries, it may be helpful to introduce additional strength and endurance training and flexibility exercises.

VARIANTS FOUND

Gene	rsID	Genotype	Message
NR3C1	rs4634384	TT	It is recommended to start training with isometric contractions. In addition, to prevent injuries, it may be helpful to introduce additional strength and endurance training and flexibility exercises.

Respiratory capacity

RESULTS

The respiratory system ensures gaseous exchange between the body and the environment, allowing the body's cells to be supplied with oxygen and to be able to eliminate so-called waste gas (carbon dioxide). Respiratory capacity is the maximum volume of air that can be emitted with a forced exhalation after a forced inhalation. It is influenced by various factors such as gender, age, stature and exercise. Respiratory volume increases significantly during exercise, drawing on both inspiratory and expiratory reserve volume. Under physiological conditions, prostaglandins perform several essential functions for the body, including the regulation of vasodilation and vasoconstriction, bronchodilation and bronchoconstriction. All these functions are related to respiratory capacity. The GSTCD gene is linked to the condition in that its variations are reflected in the ability to synthesize prostaglandins and, therefore, in respiratory capacity. In particular, the A/G or G/G genotype for the rs10516526 variant of the gene, reduces respiratory capacity compared to the A/A genotype.

Normal – No presence of genetic variants detected.

Difficulty in losing weight

RESULTS

Genetic predisposition plays an important role in the subjective ability to lose weight. Certain genetic variants, in fact, can make the slimming process difficult, even with diet and exercise.Several polymorphisms in genes involved in lipid and glucose metabolism have been studied, which can negatively or positively influence the way a person responds to calorie-restricted diets associated with fitness. Genetic variants, rs1801282 of the PPARG gene and rs10830963 of the MTNR1B gene, have been associated with weight loss. This is still being studied because these variants have a different effect in different situations. In particular, it has been observed that some carrier populations respond better to a specific training program aimed at weight loss, while others struggle to achieve this goal. The same differences were found in the two sexes, with better outcomes in the male gender than in the female (suggesting hormonal influence on body weight). In general, it can be assumed that subjects with the C/G or G/G genotype, of both above-mentioned gene variants, showed significantly greater weight loss than the C/C genotype. It is important to remember that the greater or lesser genetic propensity to lose weight is only one of the factors to be considered. If the goal is to lose weight through sport, it is always advisable to plan a specific training program, never neglecting aspects related to nutrition.

Normal – No presence of genetic variants detected.

Rotator cuff disease

RESULTS

Rotator cuff pathology is damage to the muscle-tendon complex of the scapulohumeral joint. The causes of this type of injury can have various origins. Causes of traumatic origin are represented by a fall, by functional overload following the lifting of very heavy loads or by the excessive use of the joint in sport, especially those involving repetitive movements. Causes of inflammatory origin are associated with the onset of inflammation caused by tendonitis, bursitis or arthritis of the shoulder. Causes of degenerative origin are linked to the thinning process of the tendons due to aging. The main symptom of this condition is a gradual or sudden onset of shoulder pain typically located in the front and sides of the shoulder that increases with movement. In addition to pain, patients also experience muscle weakness in the shoulder and loss of amplitude in the relative movements, which prevents the carrying out of routine activities. Treatment depends on severity. A mild form is treated with the application of ice, rest, and the use of anti-inflammatory drugs. More serious forms may require surgery. Evidence suggests that genetic factors act as intrinsic risk factors and confer genetic susceptibility to rotator cuff disease. Subjects with the C/G or G/G genotype for the rs1800972 variants of the DEFB1 gene are associated with a greater tendency to develop rotator cuff disease than those with the C/C genotype. It is advisable to pay attention to the efforts affecting the joint between shoulder and humerus, taking care to avoid jerking movements under load and, as far as possible, joint stress due to the execution of repetitive movements. It is recommended to exercise the shoulder regularly to maintain flexibility and strength of the muscles.

Flagged – Based on the genetic profile, it is highly recommended to focus part of the physical activities on exercises that aim to strengthen the shoulder muscles and improve joint flexibility.

VARIANTS FOUND

Gene	rsID	Genotype	Message
DEFB1	rs1800972	GG	Based on the genetic profile, it is highly recommended to focus part of the physical activities on exercises that aim to strengthen the shoulder muscles and improve joint flexibility.

Muscle cramps

RESULTS

A muscle cramp is a sudden, short, involuntary, painful contraction of a muscle or group of muscles. Although generally a harmless condition, it can be associated with intense pain and transient immobilization of the affected muscle. Factors associated with an increased risk of developing a muscle cramp are carrying out long periods of exercise or physical work, particularly in hot weather; the presence of certain medical conditions such as neurological or metabolic diseases; taking medications; dehydration and altered levels of magnesium and potassium in the blood. Muscle cramps can usually be treated at home with self-care measures. The T1470A (rs1049434) polymorphism in the MCT1 gene has been associated with a reduced lactate transport and subsequently a worsening of sports performance due to the impact on recovery activity after high intensity exercise. Subjects with the T/T genotype for the rs1049434 variant show a lower reduction in blood lactate than subjects with the A/A genotype, during the first 10-20 minutes of post-exercise recovery. It is advisable to carry out a correct muscle warm-up activity before exercise and to ensure sufficient hydration after exercise together with regular stretching activity. Furthermore, it is preferable to adopt a diet that gives a good supply of magnesium, potassium and calcium.

Flagged – Based on your genetic profile, it is highly recommended to plan workouts with a personal trainer who is aware of your predisposition and prevent severe muscle cramps by including a comprehensive stretching program in your sports routine, both before and after each workout.

VARIANTS FOUND

Gene	rsID	Genotype	Message
MCT1	rs1049434	TT	Based on the genetic profile, it is highly recommended to plan workouts with a personal trainer who is aware of the predisposition and prevents severe muscle cramps by including a comprehensive stretching programme in the sports routine, both before and after each workout.

Predisposition to the development of inguinal stress hernias

RESULTS

An inguinal hernia is the outflow of a portion of intestine or intra-abdominal fat from the cavity containing it in the direction of the inguinal canal (between the abdomen and thighs) due to a weakening of the abdominal wall. It is visible as a swelling, of varying consistency and volume, that produces discomfort, pain and a feeling of pressure in that area. It can also be an asymptomatic condition. It can depend on numerous factors, such as excessive body weight, intense physical exertion, sudden twisting, lifting heavy objects, sedentariness and stresses of daily life such as straining to cough, urinate and defecate. Genetics plays an important role: the EFEMP1 gene has been observed to be susceptible to the condition. This gene encodes for a component of extracellular matrix glycoproteins, so it plays a role in the maintenance/homeostasis of connective tissue. Collagen is the main structural protein of the abdominal fascia and undergoes a continuous process of synthesis and degradation. Deregulation of collagen homeostasis is believed to play an important role in the development of inguinal hernias and this occurs when the gene is mutated. The A/A genotype for the rs11899888 variant for the above gene tends to have a low predisposition for inguinal stress hernias compared to the A/G or G/G genotype, which tends to have a higher predisposition.

Normal – No presence of genetic variants detected.

Risk of suffering muscle damage

RESULTS

Damage to skeletal muscles generally occurs as a result of performing high-intensity sports activities, such as bodybuilding or weight lifting. Muscle injuries are divided into direct trauma (resulting from a direct "clash" with an opponent, as occurs in rugby, for example) and indirect contractures, strains and muscle tears. The main symptom linked to muscle damage is pain, which can have a variable intensity and lead, in the most serious cases, to the inability to move/support the affected part. Creatine kinase (CK) is a key enzyme in muscle function, as it allows the production of ATP necessary for contraction. It is therefore used as a marker of muscle distress by measuring blood concentration. There is great inter-individual variability in response to muscle damage (the most susceptible subjects suffer more serious injuries) and this variability is partly linked to the presence of variants in certain genes. One of these is CCL2, whose mutations have been associated with increased muscle distress, longer recovery time and elevated CK levels. Although the exact physiological mechanism of this association is not fully understood, carriers of the genotypes A/G and G/G for the rs1860189 variant of the CCL2 gene have been associated with altered CK levels prior to exercise and delayed recovery of muscle strength compared to the A/A genotype. This condition can lead to even serious muscle damage induced by intense exercise.

Normal – No presence of genetic variants detected.

Stress fracture

RESULTS

A stress fracture occurs when there is a small bone fracture originating not from a severe trauma but from a different cause, such as the repetitive execution of a certain movement or the sudden increase in the amount or intensity of a movement: e.g., long-distance running or repeated jumping. The individuals most at risk of a stress fracture are athletes, and if left untreated, it causes severe and continuous pain (as well as the possibility of additional complications). Anyone can suffer from a stress fracture, and some people have a predisposition associated with low bone density. Others are less predisposed to this condition due to specific protective genetic variants, as there is greater activation of certain proteins. This is the case with the RPS6KA5 gene, whose rs1286083 variant with the C/C genotype is protective for those individuals who possess it, as they have been shown to have a lower tendency to suffer stress fractures (compared to the T/C or T/T genotypes that have a regular tendency to suffer stress fractures).

Normal – No presence of genetic variants detected.

Propensity to the development of arthritic problems

RESULTS

The term arthritis refers to an inflammatory condition affecting one or more joints –the anatomical structures that bring two or more bone segments into contact with each other. Arthritis encompasses a variety of different diseases. Arthritis inflammation causes pain, stiffness and swelling in the joints and surrounding tissues. Many people mistakenly perceive arthritis as any kind of pain or discomfort associated with body movement, such as back pain, tendonitis and general stiffness or pain in the joints. However, these symptoms may not actually be caused by arthritis. An immune cell regulatory gene, PTPN22, may have the rs2476601 variant which has been linked to a change in the profile of molecules towards a pro-inflammatory state. The A/G or A/A genotype for the variant predisposes individuals to have a greater propensity to develop arthritic problems than those with the G/G genotype.

Enhanced – It is recommended to reduce stress on joints by losing weight, which will improve mobility, decrease pain and prevent joint damage. Regular movement helps maintain joint flexibility, but there are exercises that can be harmful, such as running and walking. Instead, low-impact exercises such as water aerobics or swimming are preferred to flex the joints without adding additional stress.

VARIANTS FOUND

Gene	rsID	Genotype	Message
PTPN22	rs2476601	GG	It is recommended to reduce stress on joints by losing weight, which will improve mobility, decrease pain and prevent joint damage. Regular movement helps maintain joint flexibility, but there are exercises that can be harmful, such as running and walking. Instead, low-impact exercises such as water aerobics or swimming are preferred to flex the joints without adding additional stress.

Knee osteoarthritis

RESULTS

Osteoarthritis of the knee (OA) is typically the result of wear and progressive loss of articular cartilage. It is more common in women and elderly men. Osteoarthrosis of the knee can be divided into two types: primary and secondary. Primary osteoarthrosis is joint degeneration without any apparent underlying reason. Secondary osteoarthrosis is the result of an abnormal concentration of force across the joint as in post-traumatic causes or abnormal articular cartilage. Osteoarthrosis is typically a progressive disease that can eventually lead to disability. The intensity of clinical symptoms may vary from individual to individual. Several studies have focused on the search for genes and genetic variants related to the risk of developing knee OA, with results often conflicting or only applicable to certain populations (indicating this field of study needs further investigation). One of the genes studied, the so-called matrix Gla protein (MGP) gene, was found to be associated with OA because it codes for the protein that plays a role in the regulation of vascular mineralization and bone organization. The rs1800802 mutation of the gene, more precisely the presence of the mutated G allele, increases the risk of knee osteoarthritis.

Normal – No presence of genetic variants detected.

Predisposition to epicondylitis (Tennis Elbow)

RESULTS

Epicondylitis, also known as tennis elbow, is a painful condition affecting the outside of the elbow. It is tendonitis often due to repetitive movements of the extensor muscles which, if performed incorrectly, cause microtraumas capable of damaging the tendon structures. Epicondylitis mainly occurs in cases of functional overload, affecting tennis players and those in work categories that perform repetitive movements with the arm and wrist. Elbow pain is the prevalent manifestation of epicondylitis and, if left untreated, can radiate to the forearm, wrist, and hand and persist even at rest. Other manifestations may be loss of hand grip strength, difficulty in extending the arm and in performing certain gestures such as holding a weight or an object. Several studies have focused attention on a possible genetic predisposition to tendinopathies in general and on this specific form.

Normal – No presence of genetic variants detected.

Lumbar disc disease susceptibility

RESULTS

Intervertebral disc disease is a very common condition and is characterized by the rupture/degeneration of one or more discs that separate the vertebrae of the spine causing pain in the back, neck and often in the legs and arms. The function of the intervertebral discs is to cushion the mechanical stresses deriving from the movements of the spine, preserving it from excessive stress. Although it is the discs in the lumbar region that are most affected by intervertebral disc disease, all portions of the spine can undergo this alteration. Pain, which can be limited in daily activities, tends to get worse when sitting, bending over, turning around or lifting objects. This condition is largely influenced by environmental and genetic factors. In particular, the CILP gene is expressed in a high manner in the intervertebral discs and, to an even greater extent, in the case of degeneration. For this reason, the carriers of the G allele in rs2073711, are more susceptible to the risk of intervertebral disc disease than the carriers of the A allele.

Flagged – A course of at least six weeks of physical therapy with an emphasis on core strengthening and stretching should be attempted. Non-surgical intervention includes cognitive therapy, lifestyle and activity modification that may exacerbate pain, non-steroidal anti-inflammatory drugs (NSAIDs) and epidural injections.

VARIANTS FOUND

Gene	rsID	Genotype	Message
CILP	rs2073711	GG	Fortunately, most patients will improve without surgical treatment. A course of at least six weeks of physical therapy with an emphasis on core strengthening and stretching should be attempted. Non-surgical intervention includes cognitive therapy, lifestyle and activity modification that may exacerbate pain, non-steroidal anti-inflammatory drugs (NSAIDs) and epidural injections. Epidural injections may provide moderate and short-term relief from pain due to herniated discs, but the literature on the usefulness of injections for chronic non-radiating back pain is less certain.

De Quervain's tenosynovitis

RESULTS

De Quervain's tenosynovitis is a chronic inflammation of two tendons located at the base of the thumb and the capsule that surrounds them. Its main manifestations – pain (of varying degrees), swelling and difficulty in moving – can severely limit daily and sports activities. This condition is prevalent in women and in workers who perform repetitive movements, but it is also common in some categories of athletes. In particular, the sports activities that can predispose to the development of De Quervain's tenosynovitis are tennis, squash, rowing and golf, among others. Causes of inflammation of the tendon is repeated rotation of the wrist and any trauma that may affect this part of the hand. Although environmental factors play a predominant role in its onset, genetic factors are no less important, although this field is still being explored. An important study has identified the first genetic variant associated with De Quervain's tenosynovitis: it is rs35360670 located on chromosome 8 (gene: LOC10537574). According to the authors of the study carriers of only one copy of the risk A allele has a 38% greater chance of developing tenosynovitis compared to those who do not have it and carry the non-risk allele C.

Normal – No presence of genetic variants detected.

Tendinopathy

RESULTS

The term tendinopathy refers to any injury or state of suffering of the tendons, bands of fibrous connective tissue that join muscles to bones. Tendinopathy generally originates from acute trauma (e.g., from contact sports or traffic accidents) and functional overloads (which are caused by repeated strain over time), or from certain systemic diseases (such as diabetes). Tendinopathy is responsible for local symptoms such as pain, swelling, stiffness, soreness and heat. The Achilles tendon is a tendon located in the posterior margin of the ankle and anchors the calf muscles to the heel bone. It is one of the largest tendons in the human body and bears almost all of its own weight. Athletes and runners who subject the Achilles tendon to stress are more likely to suffer from tendinopathy. The MMP3 gene encodes for proteins that are essential in the remodelling of tissues, especially connective tissue. The G/G genotype of the rs679620 variant of this gene makes individuals more prone to the condition, while other genotypes have a normal chance of developing it.

Normal – No presence of genetic variants detected.

Folate metabolism

RESULTS

The MTHFR gene encodes methylenetetrahydrofolate reductase, the key enzyme for forming 5-MTHF, the biologically active form of folate necessary to convert homocysteine into methionine. The presence of genetic variants in the MTHFR gene can significantly influence the enzyme's activity and cause an increase in homocysteine. Since high homocysteine is considered a significant risk factor for cardiovascular disease (even independently of other conventional risk factors such as arterial hypertension or diabetes), it is strongly recommended to keep the levels within normal limits. Intense physical activity can increase homocysteine levels, especially in the case of inadequate levels of B vitamins (folate and B12 in particular).

Flagged – Compensate for low metabolism with a higher intake of green leafy vegetables, especially spinach. You can also consult an expert for guidance on how to supplement folic acid in your diet.

VARIANTS FOUND

Gene	rsID	Genotype	Message
MTHFR	rs1801133	GA	Carriers of the A allele show reduced enzyme activity and low plasma folate levels. The enzymatic activity can be reduced by 70% in AA homozygotes and 35/40% in GA heterozygotes.

Glucose tolerance and lipid metabolism

RESULTS

The ADRB2 gene encodes the B2 adrenergic receptor, a member of the superfamily of receptors that plays an integral part in the autonomic nervous system and is responsible for the response to catecholamines (adrenaline, noradrenaline). ADRB2 is essential for the circulatory and respiratory systems' normal functioning and plays a critical role in immune and metabolic functions. This gene can affect glucose tolerance, influence the response to high-calorie and high-fat diets and the risk of developing obesity. Beta-adrenergic receptors are expressed on cells of the heart, skeletal muscles, adipocytes and hepatocytes. Determining the presence of genetic variants in the ADRB2 gene can help predict the response to nutritional programs for weight loss because carriers of these SNPs may have reduced lipolytic activity (ability to mobilize fat from adipocytes). Both diet and physical activity can be customized based on these genetic variants.

Flagged – Reduce the intake of refined carbohydrates/simple sugars and saturated fats. Increase that of dietary fiber, monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). Increase aerobic physical activity.

VARIANTS FOUND

Gene	rsID	Genotype	Message
ADRB2	rs1042714	GC	Carriers of the G allele may have a high BMI and risk of developing obesity. In addition, they may have difficulty losing fat deposits.

Risk of overweight and obesity

RESULTS

FTO is the gene associated with fat mass and obesity. This was the first "obesity susceptibility" gene discovered in 2007. The most relevant genetic variants were identified in the first intron. Polymorphisms in the FTO gene can also affect appetite, intake and energy expenditure. Although overweight and obesity are multifactorial conditions and cannot be determined by a single gene, individuals who carry the risk alleles in the FTO gene can benefit from low-fat diets, especially those including saturated fats, and from keeping blood sugar under control. In addition, physical activity can considerably mitigate and improve the adverse effects of the alleles at risk in combination with an adequate diet.

Flagged – The intake of saturated fats should be limited, while mono and polyunsaturated fats should be increased. It is highly recommended to eat complex carbohydrates and low glycemic index foods. A combination of a Mediterranean diet and physical activity, with a controlled intake of calories, can favourably modulate the effects of the variants at risk.

VARIANTS FOUND

Gene	rsID	Genotype	Message
FTO	rs9939609	AA	A allele is associated with a higher BMI and risk of obesity.
FTO	rs9930506	GG	G allele is associated with a higher BMI and risk of obesity.

Homeostasis of carbohydrates and lipids

RESULTS

The PPAR gamma gene encodes a protein called a receptor-gamma activated by peroxisome proliferators. This protein is one of the most important regulators of fat and glucose metabolism. It is a nuclear receptor activated by high concentrations of fats and controls the expression of genes responsible for lipid oxidation. Furthermore, the general effect of its activation is to stimulate the use of glucose in skeletal muscles. PPAR gamma is a central regulator of the differentiation of adipocytes (fat tissue cells). The presence of SNPs in this gene can significantly influence insulin secretion, sensitivity and glucose homeostasis. Any adverse effects of genetic variants can be improved and mitigated by a diet rich in complex carbohydrates, low in saturated fats, and by introducing polyunsaturated and monounsaturated fats such as extra virgin olive oil. Sedentariness can negatively worsen the effects of the alleles at risk. At the same time, it has been shown that physical activity can favorably influence this gene's expression and the receptor's function.

Normal – No presence of genetic variants detected.

Risk of developing type 2 diabetes and insulin resistance

RESULTS

The TCF7L2 gene encodes Transcription factor 7-like 2, a protein that binds to DNA and allows the expression (transcription) of genes that regulate various cellular functions, particularly those related to glucose homeostasis and insulin secretion. TCF7L2 is considered the most critical genetic "locus" influencing the risk of developing type 2 diabetes and was the first to be very significantly associated with this metabolic disorder in GWAS. It has been shown that genetic variants in this gene influence the risk of developing diabetes and insulin resistance in different populations with different genetic backgrounds. Although the exact mechanism of action has not been fully elucidated, we know that the function of TCF7L2 is that of a central regulator of metabolism in adipocytes and gene expression of genes involved in both lipid and carbohydrate metabolism. Regular physical activity, in addition to a personalized diet, can significantly mitigate the effects of genetic variants.

Normal – No presence of genetic variants detected.

Increased oxidative stress

RESULTS

The GPX1 gene encodes glutathione peroxidase 1, a member of the glutathione peroxidase enzyme family, homologues of selenoproteins and is responsible for the transformation of hydrogen peroxide into water. Both catalase and peroxidase, therefore, contribute to hydrogen peroxide metabolism, which can generate free radicals. GPX1 is the most abundant peroxidase and is a crucial antioxidant enzyme more effective than catalase. In addition, GPX1 can also reduce lipid hydroperoxides (thus protecting against damage caused by excessive fat peroxidation). Genetic variants in this gene can cause less effective enzymatic activity and consequently cause an accumulation of oxidative damage from free radicals, disturbances in the redox system and in the ability of cells to exchange signals. As with other antioxidant enzymes, it is recommended not to engage in too intense physical activity and supplement with sufficient antioxidants (diet and/or supplements). The CAT gene codes for catalase, one of the most important endogenous antioxidant enzymes. Catalase transforms hydrogen peroxide into water and oxygen, and its activity is essential in protecting cells from oxidative stress. Suboptimal catalase levels or their malfunction are found in various diseases such as Alzheimer's, cardiovascular diseases, type 2 diabetes, psychiatric disorders and cancer. Genetic variants in the CAT gene can decrease the enzyme's activity and increase oxidative stress.

Normal – No presence of genetic variants detected.

Tendency to hyperinflammation

RESULTS

The IL-6 gene encodes interleukin 6, one of the most important pro-inflammatory cytokines. IL-6 has multiple functions in integrating immune reactions and is mainly involved in immunocompetence (ability to respond adequately to infections). Elevated levels of IL-6 are observed in individuals with major autoimmune diseases (e.g., Multiple Sclerosis) or acute inflammatory responses. Furthermore, obesity and visceral adiposity are positively associated with high levels of IL-6, which would suggest its crucial role in maintaining conditions characterized by chronic low-grade inflammation. Genetic variations in this gene can worsen inflammatory responses. Alternatively, moderate physical activity can mitigate the effects of the SNP and improve inflammation through a decrease in fat, especially visceral, which increases the production of IL-6.
The IL-1 beta gene encodes interleukin beta 1, one of the most potent pro-inflammatory cytokines, crucial in the defense response against infections and trauma. As with other inflammatory cytokines, IL-1 beta is essential to ensure adequate immune response, but its excess can cause damage to organs and tissues. Obesity and visceral adiposity have been significantly associated with high levels of this cytokine. Moderate but not high-intensity physical activity can improve chronic inflammation and mitigate the effects of the SNP.
The TNF-alpha gene encodes tumor necrosis factor-alpha, a pro-inflammatory and adipokine cytokine produced primarily by macrophages/monocytes during an acute inflammatory response and by natural killer cells and lymphocytes. TNF-alpha plays an essential role in fighting infections and cancer, but an excess of it causes tissue damage caused by excessive inflammation. Genetic variants can lead to inflammatory dysfunction and an increased risk of low-grade chronic inflammation. Physical activity can significantly improve TNF-alpha levels, but the results are more significant when associated with an adequate diet.

Flagged – Follow an anti-inflammatory diet rich in fresh fruit and vegetables, aromatic herbs and spices, and good quality fats (prefer monounsaturated foods such as extra virgin olive oil and omega 3). Limit the consumption of simple sugars and keep blood sugar levels constant by eating low/medium glycemic index foods. Physical exercise of moderate intensity can increase the production of IL-6 in skeletal muscles. In this case, if the quantity is not excessive, the effects are beneficial for blood sugar and reducing fat deposits. However, an excess can have harmful effects. The intensity of physical activity must therefore be assessed in the case of the presence of SNP by a sports nutrition expert.

VARIANTS FOUND

Gene	rsID	Genotype	Message
IL-6	rs1800795	CG	Carriers of the G allele can have high circulating IL-6, which can worsen the severity of inflammatory conditions. Furthermore, the G allele has been shown to be positively associated with the risk of type 2 diabetes and polycystic ovary.

Retinol levels

RESULTS

The BCO1 gene, also known as BCMO1, codes for beta-carotene oxygenase 1, a key enzyme for transforming beta-carotene into vitamin A. This enzyme catalyzes the division of the betacarotene molecule into two retinol molecules and is expressed mainly in the small intestine/duodenum. The presence of genetic variations can lead to low levels of conversion from carotene to vitamin A. Vitamin A is one of the most important antioxidants, and therefore, it is necessary to have adequate quantities to ensure that physical activity, mainly if at high intensity, does not produce an excess of free radicals.

Normal – No presence of genetic variants detected.

Vitamin B12 levels

Results

The FUT2 gene codes for fucosyltransferase 2, an enzyme that mediates the inclusion of fucose (a special sugar) in glycoproteins and glycolipids. FUT2 is involved in expressing antigens on the cells that determine our type of blood group. The antigen synthesized by FUT2 also mediates as helicobacter pylori attach to the gastric mucosa. It was therefore observed that the presence of genetic variants in FUT2 could increase the risk of this infection and lead to low levels of vitamin B12. Vitamin B12 is essential in the formation of red blood cells and the synthesis of DNA/RNA. It is also involved in the metabolism of amino acids and fats. If its levels are not adequate, it is possible to experience fatigue, lack of concentration and even neurological severe pathologies. Iron, folic acid and vitamin B12 are particularly critical in athletes. A very intense physical activity can also lead to "sports pesudoanemia". It is advisable, in the case of genetic variants, to ensure that the levels of vitamin B12 in the blood are adequate (in addition to Fe and folate).

Flagged – Measure the level of Vitamin B12 and take a test to verify the presence of H.pilory infection (breath test or stool analysis). If necessary, take a Vitamin B12 supplement after consulting a nutrition and health provider. Increase the intake of animal foods that are rich in vitamin B12 such as meat, fish, dairy, eggs or fortified foods.

Genotype found

Gene	rsID	Genotype	Message
FUT2	rs602662	GG	GG carriers may have low level of vitamin B12 and be more susceptible to H. pylori infection.

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GLOSSARY

ALLELE	An allele is a variant form of a gene that is located at a specific position (or genetic locus) on a specific chromosome. Humans have two alleles at each genetic locus, with one allele inherited from each parent.
CHROMOSOME	A chromosome is a condensed thread-like structure of DNA that carries hereditary information, or genes. Human cells have 22 chromosome pairs plus two sex chromosomes with a total of 46 per cell.
GENOME	A genome is an organisms'complete set of DNA, including all of its genes. Each genome contains all the information needed to build and maintain that organism. In humans, a copy of the entire genome—more than 3 billion DNA base pairs—is contained in all cells that have a nucleus.
GENOTYPE	A genotype is the genetic makeup of an individual organism. It may also refer to just a particular gene or set of genes carried by an individual. The genotype determines the phenotype, or observable traits of the organism.
ODDS RATIO	The odds ratio is a way of comparing whether the odds of a certain outcome is the same for two different groups. In this report, the odds ratio estimates the probability of a condition occurring in a group of people with a certain genetic variant compared to a group of people without that same variant. An odds ratio of 1 means that the two groups are equally likely to develop the condition. An odds ratio higher than 1 means that the people with the genetic variant are more likely to develop the condition, while an odds ratio of less than1 means that people with the variant are less likely to develop the condition.
PHENOTYPE	Phenotype is a description of an individuals'physical characteristics, including appearance, development and behavior. The phenotype is determined by the individual's genotype as well as environmental factors.
POPULATION ALLELE FREQUENCY	The allele frequency represents the incidence of a variant in a population. Alleles are variant forms of a gene that are located at the same position, or genetic locus, on a chromosome.
SNP	Single nucleotide polymorphisms, frequently called SNPs, are the most common type of genetic variation among people. A SNP is a variation in a single nucleotide that occurs at a specific position in the genome.