FITNESS GENOMICS

Category Summary

ENDURANCE RELATED

5.4

Endurance

3.8

Aerobic Capacity Trainability

1.6

Lactate Threshold

Endurance

What is Endurance ?

Endurance is the ability of the body to sustain a physical activity for a prolonged period of time. A high endurance capacity indicates that an individual can take up mild to moderate intensity activities for a prolonged duration with minimal discomforts like breathlessness and fatigue. Endurance performance is dictated by factors such as the aerobic capacity, fat oxidation, aerobic metabolism, lactate threshold, exercise economy, and percentage of slow twitch muscle fibers. Genetics play a big role in these factors, and hence dictate whether an individual is suited for endurance activities or not.

5.4

Endurance

Interpretation

You have a typical genetic profile for Endurance. People with such a genetic profile usually tend to have an average ability for endurance activities and find it tough to reach very high levels of performance in endurance events. However, following a strict training regimen could offset the disadvantage provided by genetics.

Gene Table

Gene Name: MCT1 | Your Genotype: AA

The MCT1 gene codes for a protein that is responsible to transport lactate across the cell membrane which is of prime importance in skeletal tissues. The MCT1 gene also influences the transport of molecules used to produce ATP; the energy currency of the cells. Studies have associated a variant of MCT1 with endurance athlete status and blood lactate level after intensive exercise.

Gene Name: TFAM | Your Genotype: GC

Mitochondria is essential for energy production, which is crucial for performing physical activities/exercises. Therefore, maintaining an optimum level of mitochondrial DNA and the expression of its genes are significant for energy supply. The TFAM gene encodes for a protein (mitochondrial transcription factor A), which is required for the expression of mitochondrial DNA and the protection of cells against oxidative stress. It has been noted that physical, aerobic activities tend to increase the expression of TFAM and subsequently, the number of mitochondrial DNA. Studies have found an association between a variation of this gene and physical performance in athletes.

Gene Name: UCP2 | Your Genotype: CC

The UCP2 gene encodes for a protein (mitochondrial uncoupling protein 2) which is involved in regulating lipid metabolism and energy expenditure. Endurance training can cause an increase in UCP2 mRNA and protein content in skeletal muscles. A variation in the UCP2 gene has been found to be associated with altered body mass index (BMI), physical activity, and changes in energy expenditure. A specific genotype has been associated with higher exercise efficiency, enhanced metabolic efficiency, and physical activity.

Gene Name: UCP3 | Your Genotype: CC

Uncoupling proteins (UCPs) play a role in energy expenditure, thermogenesis (production of body heat), regulation of free fatty acids, and reduction of reactive oxygen species (buildup of such molecules can be harmful). The UCP3 gene encodes for a protein (mitochondrial uncoupling protein 3 - UCP3), which is selectively expressed in skeletal muscles. UCP3 protein is involved in regulating energy metabolism, weight control, and in modulating the use of fat and glucose for energy generation. A variation in the UCP3 gene has been shown to be associated with endurance athletes.

Gene Name: GNB3 | Your Genotype: CC

The GNB3 gene encodes for the Gβ3 subunit of G proteins. It has been suggested that a variation in this gene is associated with enhanced G protein activation and G proteins are believed to be influenced by aerobic exercise.

Gene Name: TSHR | Your Genotype: TT

The TSHR gene encodes for a protein that influences the production of thyroid hormones and regulates thyroid cell metabolism. The thyroid hormones have an effect on skeletal muscle tissue. A variation of the TSHR gene is associated with its higher expression, which in turn may result in increased angiogenesis (formation of new blood vessels) and/or the metabolic rate, which are factors that have a direct influence on aerobic performance.

Gene Name: HIF1A | Your Genotype: CC

HIF1A can influence response to hypoxia (deprivation of adequate oxygen supply) and oxygen uptake of cells by activating genes that affect the formation of red blood cells and blood vessels. It mediates the adaptation of skeletal muscles to endurance training.

Gene Name: GABPB1 | Your Genotype: AA

GABP1 is a genetic marker in endurance athletes. The GABPB1 gene plays a role in the production of Nrf2 protein. As a response to exercise and the increased in the demand for energy in the muscles, Nrf2 protein improves respiratory capacity and increases the rate of ATP (energy) production. Therefore, variants of the GABPB1 gene may influence the aerobic capacity for endurance athletes.

Gene Name: RBFOX1 | Your Genotype: AG

The RBFOX1 gene encodes for a protein (RNA-binding protein, fox-1 homolog 1), which is key for regulating gene expression. This protein can influence muscle differentiation. A variation of the RBFOX1 gene has been associated with favorable muscle function in endurance athletes; this variation has been shown to be over-represented in endurance athletes when compared with power athletes.

Gene Name: ACE | Your Genotype: AA

The ACE gene plays a role in the production of an enzyme (angiotensin II) which controls blood pressure and balances the fluid and salt in the body. Certain variants of this gene can help in making better improvements during higher intensity training. Certain variation of the ACE genes shows a greater response to strength endurance training.

Gene Name: SLC2A4 | Your Genotype: AG

The SLC2A4 gene encodes for a protein [solute carrier family 2 (facilitated glucose transporter), member 4, also known as a GLUT4], which plays an important role in the regulation of glucose metabolism by facilitating glucose uptake by muscles cells. this is required for energy production during endurance activities.

Gene Name: CKM | Your Genotype: AG

This gene encodes the muscle-specific protein creatine kinase. It is an enzyme involved in maintaining energy homeostasis in the muscle cell. It is associated with the physical performance of skeletal muscles and contributes to the uptake of maximum oxygen (VO2max) response during endurance training.

Gene Name: EPAS1 | Your Genotype: AG

The EPAS1 gene gives instructions for making a protein; which is one part (subunit) of a larger protein complex, playing a critical role in the body's ability to adapt to changing oxygen levels. This gene enables activities that favor the delivery of oxygen to the tissues during endurance exercises thus influencing the performance.

Gene Name: COL6A1 | Your Genotype: TC

This gene encodes for the protein collagen alpha-1(VI) chain. Type VI collagen is located in the space surrounding cells that make up the muscles used for movement (skeletal muscle cells) and cells that make up connective tissue, which provides strength and flexibility to structures throughout the body, including skin and joints. Collagen VI regulates the formation of fine fibrils present in collagen fibers.

Gene Name: PPARA | Your Genotype: GG

The PPARA gene is important for the production of a protein which in turn activates other genes and also regulates the oxidation of fatty acid during exercise. This gene has an effect on the body's response to various exercises; when cells are deprived of sufficient energy during certain conditions that use up the body's energy stores, e.g. during exercise, the PPARA gene is activated. Variants of the PPARA gene may influence the endurance sports activity of the athlete.

Gene Name: PPARGC1A | Your Genotype: AG

The PPARGC1A gene plays a role in the production of a protein that has beneficial effects on the body, following exercise. PPARGC1A affects oxygen utilization and muscle fatigue and certain variants of the PPARGC1A gene may influence the endurance performance; it also has a direct effect on skeletal muscle function during a marathon, hence affecting the lactate threshold.

Gene Name: ADRB2 | Your Genotype: AG

The ADRB2 gene influences how sensitive our body can be to the effects of adrenaline. Variations in the ADRB2 gene can affect heart rate, and lead to increased blood to be pumped around the body, which transports oxygen and nutrients to muscles; it can increase the size of the windpipe, thereby allowing more oxygen to be taken in. The ADRB2 gene expresses throughout the cardiovascular, respiratory, metabolic, and musculoskeletal systems, along with increasing the breakdown of fat (lipid metabolism), which acts as a fuel during exercise, thus influencing endurance performance.

Gene Name: PPARGC1B | Your Genotype: GG

The PPARGC1B gene encodes for a protein [peroxisome proliferator-activated receptor gamma, coactivator 1 beta (PGC1β)]. PPARGC1B along with the PPARGC1A gene play key roles in regulating adipogenesis (formation of fat cells), insulin signaling, lipolysis (the breakdown of fat), mitochondrial biogenesis (production of new mitochondria), angiogenesis (formation of new blood vessels), and hepatic gluconeogenesis (production of glucose by the liver). Variations in the PPARGC1B and PPARGC1A genes have been reported to influence muscle morphology, oxygen uptake, power output, and endurance performance, which can be associated with elite athletic performance.

Gene Name: HFE | Your Genotype: CC

This gene encodes for the protein (homeostatic iron regulator) which is essential for the regulation of iron absorption. Iron in turn is essential for energy metabolism, and transportation of oxygen to the tissue from the blood, hence influencing the endurance activity.

Gene Name: PPARD | Your Genotype: TT

The PPARD gene encodes for a protein that can affect energy production. In muscle tissues, the expression of this gene is increased due to exercise, which can result in increased fat burning capacity and an increase in type I muscle fibers. Type I muscle fibers are the main group of muscles used in activities such as distance running, cycling, swimming, and endurance training.

Gene Name: VEGFA | Your Genotype: GC

The VEGFA gene plays a role in the production of a protein that is crucial in the process of exercise-induced angiogenesis, which is the formation of new blood vessels brought on by exercise. Variations of this gene can influence VO2max before and after aerobic exercise training hence influencing the endurance status of the athlete.

Gene Name: NOS3 Your Genotype: TT

A variant of NOS3 gene is associated with the production of an enzyme (eNOS) that affects nitric oxide production, which in turn influences the process that can help regular blood pressure (endothelium-dependent vasodilation) in response to exercise. Higher energy expenditure can significantly increase the activity of the NOS3 gene and vasodilation associated with physical activities. Some variants are associated with endurance performance.

Gene Name: AQP1 Your Genotype: GG

This gene encodes for the protein Aquaporin 1. AQP1 facilitates the transfer of water from the blood into the muscle and promotes water reabsorption. Regulation of water flow across cell membranes is essential for supporting inter- and intracellular fluid balance, which is critical for health and exercise performance. AQP1 functions are vital during exercise and have a profound influence on endurance running performance.

Gene Name: COL5A1 Your Genotype: TT

This gene encodes for the protein collagen alpha-1(V) chain, which is found in ligaments, tendons, and other tissues containing type I collagen. The COL5A1 gene has been associated with both endurance running performance and sit-reach range of motion flexibility test.

Do's and Don'ts

Do's

- Give emphasis to all the trainable factors of endurance performance such as aerobic capacity, lactate threshold, mental endurance, resistance to fatigue, and exercise economy.
- Increase mileage and intensity progressively so as to not get injured.
- Consider the use of supplements as they may improve endurance performance, e.g. caffeine, beta-alanine.
- Cut down on weight as this also improves exercise economy.
- Undertake carbohydrate loading before long distance running.
- Take adequate rest after high intensity or high volume workouts.

Don'ts

- Avoid training only with long distance and low intensity sessions.
- Avoid improper exercise techniques.
- Avoid improper nutrition as this can hamper energy levels and muscle recovery.

Aerobic Capacity Trainability

What is Aerobic Capacity Trainability ?

Aerobic capacity, also known as VO2Max, is defined as the maximum capacity of our body to transport and use oxygen during exercise. During aerobic exercises, oxygen is used to break down the fuel stores for energy production and its demand increases with increase in the intensity of exercise. Appropriate training leads to an improvement in the aerobic capacity which directly translates to improved performance. However, the extent and the ease at which these improvements are made is governed by genetics. People with favourable genetics find it very easy to improve their aerobic capacity, while others can find it very difficult. Various genes that are involved in cellular oxygen supply and utilization regulate the trainability of aerobic capacity.

3.8

Aerobic Capacity Trainability

Interpretation

As per your genotype, your Aerobic Capacity Trainability is good. People with such a genotype usually find it easy to make improvements in their aerobic capacity with appropriate training, thereby improving their aerobic performance. This directly translates to an improved performance in aerobic activities.

Gene Table

Gene Name: CAMTA1 | Your Genotype: AA

The CAMTA1 gene encodes for a protein (calmodulin-binding transcription activator 1), which is a transcriptional activator (a protein that increases the first step in the process of gene expression). Studies have associated variations of this gene with lesser gains in VO2max.

Gene Name: CNTF | Your Genotype: GA

The CNTF gene encodes for a protein (ciliary neurotrophic factor) which plays a role in neuronal and muscle tissues. Studies have associated a variant of this gene with greater muscle strength and muscle quality at relatively fast contraction speeds, leading to the conclusion that improved muscle strength and quality may result in increased aerobic power.

Gene Name: GSTP1 | Your Genotype: AA

The GSTP1 gene influences the production of an enzyme which plays an important role in detoxification by reducing the damaging effects of certain compounds produced during exercise.

Gene Name: Near DBX1 | Your Genotype: AA

This variant is located near the DBX1 gene. The DBX1 gene encodes for a protein (developing brain homeobox 1), which is involved in the neuronal fate, allowing specification of nerve cells which play a role in primary biological functions like locomotion (movement) or breathing.

Gene Name: CAT | Your Genotype: TC

The CAT gene plays a key role in the production of an enzyme, catalase. Catalase helps in breaking down toxic substances and convert them to water and oxygen, therefore reducing the toxic effects of such substances. With adequate exercise, VO2max can show significant improvement at a higher rate in people with certain variations of this gene.

Gene Name: AKT1 | Your Genotype: TT

The AKT1 gene plays a role in the growth and metabolism of skeletal muscles. Variations in this gene may influence one's responses to aerobic training.

Gene Name: Near DAAM1 | Your Genotype: GA

This variant is located near the DAAM1 gene. Studies have associated this variant with gains in V̇O2max. The DAAM1 gene encodes for a protein (dishevelled associated activator of morphogenesis 1), which, in skeletal muscle tissue regulates cell growth and promotes the growth and arrangement of new actin filaments, which play a role in creating the force responsible for muscle contraction.

Gene Name: HIF1A | Your Genotype: CC

HIF1A can influence response to hypoxia (deprivation of adequate oxygen supply) and oxygen uptake of cells by activating genes that affect the formation of red blood cells and blood vessels. These factors play a role in determining aerobic capacity.

Gene Name: Near NDN | Your Genotype: GG

This variant is located near the NDN gene. Studies have associated this variant with gains in V̇O2max. The NDN gene encodes for a protein (necdin), which acts as a growth suppressor.

Gene Name: GABPB1 | Your Genotype: AA

The GABPB1 gene plays a role in the production of Nrf2 protein. As a response to exercise and the increased in the demand for energy in the muscles, Nrf2 protein improves respiratory capacity and increases the rate of ATP (energy) production. Therefore, variants of the GABPB1 gene may influence the aerobic capacity for endurance athletes.

Gene Name: Near BIRC7 | Your Genotype: GG

This variant is located near the BIRC7 gene. The BIRC7 gene encodes for a protein (baculoviral IAP repeat-containing protein 7), which plays a key role in programmed cell death, cell proliferation, and cell cycle control. Variation in this gene has been associated with the training response of VO2max.

Gene Name: PPARA | Your Genotype: GG

The PPARA gene is important for the production of a protein which in turn activates other genes and also regulates the oxidation of fatty acid during exercise. This gene has an effect on the body's response to various exercises; when cells are deprived of sufficient energy during certain conditions that use up the body's energy stores, e.g. during exercise, the PPARA gene is activated.

Gene Name: Near ZIC4 | Your Genotype: AA

This variant is located near the ZIC4 gene. Studies have associated this variant to the V̇O2max response to training. The ZIC4 gene encodes for a protein which plays a key role during development. This gene is expressed in the central nervous system and is found to have an effect on motor development and muscle tone.

Gene Name: Near KCNH8 | Your Genotype: TT

This variant is located near the KCNH8 gene. This variant was found to be a predictor of V̇O2max response to exercise training. The KCNH8 gene encodes for a protein (potassium voltage-gated channel subfamily H member 8), which is primarily expressed in the human nervous system.

Gene Name: ACSL1 | Your Genotype: GA

The ACSL1 gene was found to have a strong influence on VO2max training response by driving complex processes in the cells which affect the availability of ATP, a chemical that provides energy to drive many cellular processes.

Gene Name: PPARGC1A | Your Genotype: AG

The PPARGC1A gene plays a role in the production of a protein that has beneficial effects on the body, following exercise. PPARGC1A affects oxygen utilization and muscle fatigue and certain variants of PPARGC1A can influence endurance performance.

Gene Name: NR3C1 | Your Genotype: GG

The NR3C1 gene influences cortisol sensitivity. Cortisol is a hormone that can be beneficial as a response to stress, including physical stress. However, while undertaking high volumes of exercise without enough recovery time, there may be a rise in cortisol levels for long periods. Prolonged exposure can lead to the breakdown of muscle tissue therefore negatively impacting muscle gains and exercise performance.

Gene Name: ADRB2 | Your Genotype: AG

The ADRB2 gene influences how sensitive our body can be to the effects of adrenaline. Variations in ADRB2 gene can affect heart rate, and lead to increased blood to be pumped around the body, which transports oxygen and nutrients to muscles; it can increase the size of the windpipe, thereby allowing more oxygen to be taken in; and it can also increase the breakdown of fat, which acts as a fuel during exercise. Such effects brought on by different variations of this gene influence one's response to better improvements in VO2max.

Gene Name: Near PRDM1 | Your Genotype: GA

This variant is located near the PRDM1 gene. This variant was found to play a significant role as a VO2max predictor. The PRDM1 gene encodes for a protein (PR domain zinc finger protein 1); increased expression of this protein can result in the immune response through antibody-secreting plasma cells (a type of white blood cell). It also plays a role in regulating of hematopoietic stem cells (cells that produce blood cells).

Gene Name: PPARD | Your Genotype: TT

The PPARD gene encodes for a protein that can affect energy production. In muscle tissues, the expression of this gene is increased due to exercise, which can result in increased fat burning capacity and an increase in type I muscle fibers. Type I muscle fibers are main group of muscles used in activities such as distance running, cycling, swimming, and endurance training. Variations in the PPARD gene can influence the change in aerobic fitness during lifestyle interventions.

Gene Name: VEGFA | Your Genotype: GC

The VEGFA plays a role in the production of a protein that is crucial in the process of exercise-induced angiogenesis, which is the formation of new blood vessels brought on by exercise. Variations of this gene can influence VO2max before and after aerobic exercise training.

Gene Name: Near GRIN3A | Your Genotype: AA

This variant is located near the GRIN3A gene. The GRIN3A gene encodes for a protein (glutamate ionotropic receptor NMDA type subunit 3A), which is expressed in neural cells. Variations associated with the GRIN3A gene were found to be strong predictors of VO2max trainability.

Gene Name: Near RGS18 | Your Genotype: GG

This variant is located near the RGS18 gene. Studies have associated this variant with gains in V̇O2max. The RGS18 gene encodes for a protein (regulator of G protein signaling 18), which increases the conversion of GTP to GDP. G proteins play key roles in various cellular processes including cell growth and protein synthesis.

Do's and Don'ts

Do's

- Undertake High Intensity Interval Training (HIIT) workouts, as they are most effective in increasing aerobic capacity. High intensity intervals should be undertaken at greater than 85% of maximum heart rate.
- Keep one HIIT session a week, as this is recommended to improve aerobic capacity.
- Consume foods rich in iron and vitamin B complex, as these can be helpful.

Don'ts

- Avoid the use of nicotine and tobacco containing products such as cigarettes.
- Avoid only undertaking slow long distance training sessions for base building; focus on high intensity sessions.

Lactate Threshold

What is Lactate Threshold ?

Lactate is produced by the body during anaerobic glycolysis. This lactate is further used as a fuel by the aerobic metabolism pathway for energy generation. However, during intense exercise, the aerobic system is not able to use up all the lactate produced by the anaerobic system which results in an increase in the concentration of lactate. This directly correlates with muscle fatigue. Therefore, lactate threshold is defined as the intensity of exercise at which the concentration of lactate begins to exponentially increase, thereby setting in fatigue. Intensity of exercise below the lactate threshold can be done without any apparent feeling of uneasiness and fatigue. Therefore, a higher lactate threshold leads to an improved performance since higher intensity of exercise can be achieved.

1.6

Lactate Threshold

Interpretation

The genetic component of your Lactate Threshold is excellent. People with such a genotype tend to have excellent lactate clearance and utilization, making them genetically very well suited for endurance activities. They tend to sustain a higher intensity of effort without fatigue.

Gene Table

Gene Name: MCT1 | Your Genotype: AA

The MCT1 gene encodes for a protein (monocarboxylate transporter 1), which influences the transport of lactate across membranes, to produce ATP, the energy currency for cells. This is an important process for cell metabolism, including that of skeletal muscles. Defects in lactate transporter in skeletal muscles may cause fatigue and muscle cramping during exercise. Variants of the MCT1 gene can influence the onset of fatigue. Expression of MCT1 in muscles can help to offset fatigue; increased MCT1 expression may imply a reduced likelihood of experiencing fatigue easily.

Gene Name: PPARGC1A | Your Genotype: AG

The PARAGC1A gene is believed to influence the availability of chemicals during the later stages of a marathon and conversion to these chemicals to ATP, the body's energy currency. This influence has a direct effect on skeletal muscle function during a marathon, therefore affecting one's lactate threshold.

Gene Name: PPARD | Your Genotype: AA

The PPARD gene encodes for a protein that can affect energy production. In muscle tissues, the expression of this gene is increased due to exercise, which can result in increased fat burning capacity and an increase in type I muscle fibers. Type I muscle fibers are the main group of muscles used in activities such as distance running, cycling, swimming, and endurance training.

Do's and Don'ts

Do's

- Undertake fartlek sessions and sprint training as they improve lactate threshold.
- Undertake high intensity training as this is optimal for improving lactate threshold; the intensity of workout should be above the lactate threshold, corresponding to around 85%-95% of maximal heart rate.
- Perform at least one lactate threshold improving workout (like the ones mentioned above) every week.

Don'ts

- Avoid conventional steady runs for improving lactate threshold as they are not efficient in doing so.

Category Summary

POWER RELATED

6.9

Power

Power

What is Power ?

Power is the ability of the muscles to generate large forces at a rapid rate, as observed during high intensity activities of shorter duration. Activities such as jumping, powerlifting, sprinting, bodybuilding, and short-distance swimming utilize the power generation capabilities of the muscle. Generally, a greater power output directly translates into improved performance in such activities. Genetics play a big role in the power generation capabilities of an individual, and hence dictate whether an individual is suited for power activities or not.

6.9

Power

Interpretation

You have a poor genetic predisposition for Power generation. People with such a genotype are usually ill-suited for power and strength activities. Despite appropriate training, people with such a genetic profile tend to find it difficult or are even unlikely to reach high levels of performance in power and strength events.

Gene Table

Gene Name: MCT1 | Your Genotype: AA

Transport of lactate across cell membranes is of prime importance in skeletal tissues and the MCT1 gene codes for a protein that is responsible for this function. Studies have associated a variant of MCT1 with elite power athletes.

Gene Name: MTHFR | Your Genotype: AA

While undergoing high-intensity exercises, muscle cells tend to go through a number of processes. One of the main responses is the increase in muscle mass aided by the proliferation of muscle cells, which is further dictated by a chemical process called, DNA methylation processes. The MTHFR gene is crucial for this process. A variation in this gene is associated with the ability of skeletal muscles to adapt and respond to exercises.

Gene Name: AGT | Your Genotype: CT

The AGT gene codes for a protein (angiotensinogen) that can control blood pressure and influences the response to power-based training. A variant of this gene can result in higher levels of angiotensinogen in the blood, further leading to higher levels of angiotensin II, which may help in the greater growth of muscles and muscle mass gain with strength training activities, commonly performed by power athletes.

Gene Name: ACTN3 | Your Genotype: TT

The ACTN3 gene influences the production of a protein found in fast-twitch muscle fibers, which are the kind of muscle fibers important for movement requiring power, such as weightlifting or sprinting. Variations in the ACTN3 gene can control the production of the protein which in turn influences the amount of fast-twitch muscle fiber produced.

Gene Name: IGF1 | Your Genotype: CT

The IGF1 gene plays a key role in the growth and increased growth of skeletal muscles, along with other specific tissues. A variation of the IGF1 gene is believed to be associated with higher levels of the growth factor which in turn can influence increased muscle mass. This variant was found to be associated with elite power athletes.

Gene Name: HIF1A | Your Genotype: CC

The HIF1A gene can influence the body's response to hypoxia (deprivation of adequate oxygen supply) and oxygen uptake of cells by activating genes that affect the formation of red blood cells and blood vessels. A variation of HIF1A gene encodes for a subunit of a protein (HIF-1), which was found to be associated with increased gene expression and stability of HIF1A protein. This results in the increased resistance of cells to hypoxia and is associated with power-related athletics.

Gene Name: IGF1R | Your Genotype: AA

The IGF1R is a transmembrane receptor that mediates the effects of IGF1. IGF1 plays a key role in the increased growth of skeletal muscles, along with other specific tissues. A variation of this gene is found to be associated with higher levels of the IGF1 which can result in increased muscle mass. Studies have associated a variant of IGF1R gene with elite power athletes.

Gene Name: ACE | Your Genotype: AA

The ACE gene plays a role in the production of an enzyme (angiotensin II) which controls blood pressure. Certain variants of this gene can help in making better improvements during higher intensity training. Some variants can also result in a higher proportion of fast-twitch muscle fibers, such muscle fibers are predominantly involved in rapid movements requiring more power, such as jumping or sprinting.

Gene Name: CKM | Your Genotype: AG

The CKM gene encodes a muscle-specific protein (creatine kinase) which affects skeletal muscle performance, and hence influences physical performance and differences in the body's response to power training.

Gene Name: PPARA | Your Genotype: GG

The PPARA gene is important for the production of a protein which in turn activates other genes and also regulates the oxidation of fatty acid during exercise. This gene has an effect on the body's response to various exercises; when cells are deprived of sufficient energy during certain conditions that use up the body's energy stores, e.g. during exercise, the PPARA gene is activated.

Gene Name: AGTR2 | Your Genotype: CC

A variation of the AGTR2 gene is associated with an increased proportion of fast-twitch muscle fibers which are predominantly involved in rapid movements requiring power, such as jumping, sprinting, or weightlifting. Therefore, this gene is important in determining athletic performance and power athlete status.

Gene Name: PPARG | Your Genotype: CC

The PPARG gene plays a role in athletic performance as it is important for the regulation of bone mass, which in turn affects the load transfer ability in athletes. enhances bone development. A variation in the PPARG gene may result in increased bone mass and therefore, the presence of this variation can lead to an athlete having stronger bones that are more efficient in withstanding extreme forces and load transfer. This ability is particularly beneficial for athletes involved in power-related sports, e.g. weightlifting.

Gene Name: SOD2 | Your Genotype: TT

The SOD2 gene encodes for a protein that helps in creating an antioxidant that plays a key role in energy production within the cells by preventing excess damage to the cells caused by free radicals. A variation in the SOD2 gene can increase or decrease the efficiency of the process. However, the process of reducing the harmful effects of free radicals results in the formation of water and hydrogen peroxide. Therefore, although efficient functioning of this gene can help in neutralizing free radicals, it can lead to an increase in the levels of hydrogen peroxide, which can be damaging. Therefore, it is important to maintain an adequate intake of antioxidants to reduce the risk of hydrogen peroxide buildup.

Gene Name: NOS3 | Your Genotype: TT

A variant of NOS3 gene is associated with the production of an enzyme (eNOS) that affects nitric oxide production, which in turn influences the process that can help regular blood pressure (endothelium-dependent vasodilation) in response to exercise. Higher energy expenditure can significantly increase the activity of the NOS3 gene and vasodilation associated with physical activities.

Gene Name: IL6 | Your Genotype: GG

The IL6 gene helps in the production of interleukin-6 (IL-6), a molecule that plays a key role in the immune system, athletic performance, and muscle recovery. During exercise, muscles tend to release IL-6, which may result in increased levels of IL-6 in the blood. Research suggests that IL-6 released by muscles have many beneficial effects. A variant of IL6 gene is found to be associated with power athletes and this may provide an advantage when it comes to the performance in certain power-related sports like sprinting and jumping.

Gene Name: MSTN | Your Genotype: AA

The MSTN gene encodes for a protein (myostatin), which helps to regulate the proliferation of muscle cells and in turn influences muscle mass and strength. A variation in the MSTN gene has been found to be associated with the ability to generate ‘peak’ power during muscle contractions.

Do's and Don'ts

Do's

- Engage in plyometric training to improve muscular power output.
- Add muscle building cycles to your training program since muscle building will directly lead to greater power/strength.
- Train with less exercise volume but heavy weights/intensity since high power output can be achieved by enhanced neuromuscular coordination and output.
- Consider the use of supplements such as creatine as they can be beneficial.

Don'ts

- Avoid participating in competitive level power/strength activities as these are not recommended due to a genetic disadvantage for them.
- Avoid sudden increase in intensity as this can lead to injuries; make gradual jumps in intensity.
- Avoid incorrect form during power/strength movements since this can lead to injuries.
- Avoid eating a caloric deficit diet.
- Avoid beginning workouts without proper warmup and stretching.

Category Summary

INJURY RISK

9.0
Achilles Tendinopathy

6.4
Muscle Injury

7.1
Rotator Cuff Injury

6.0
Anterior Cruciate Ligament Injury

6.5
Tennis Elbow

6.9
Concussion

Achilles Tendinopathy

What is Achilles Tendinopathy ?

The achilles tendon attaches muscles at the back of the lower leg to the heel bone. It is the thickest tendon in the human body. Achilles tendinopathy is an overuse injury that is common, especially to people performing running and jumping activities, due to the repetitive action at the achilles tendon. It can also be caused by other factors such as trauma, rheumatoid arthritis, wearing high heel shoes, and certain medications. Symptoms can vary from an ache or pain and swelling in the local area of the ankles to a burning sensation that surrounds the whole joint. The pain associated with this condition is usually worse during and after activity and the tendon and joint area can become stiffer the following day, as swelling hampers the movement of the tendon.

9.0

Achilles Tendinopathy

Interpretation

As per your genotype, you have a highly elevated risk for Achilles Tendinopathy. People with such genetics usually have achilles tendons that are not predisposed to withstand greater physical trauma.

Gene Table

Gene Name: MIR608 | Your Genotype: CC

The MIR608 gene belongs to a family of genes that is responsible for the production of microRNAs which regulate gene expression. This gene is also found to play a role in regulating the expression of a protein in cartilage cells. A variation of the MIR608 gene is found to be associated with tendinopathy.

Gene Name: MMP3 | Your Genotype: AA

The MMP3 gene plays a role in the production of an enzyme that is involved in the breakdown of several cell proteins including collagens III, IV, IX, and X. Therefore, influencing the process of tissue remodeling, which is the process of reorganization/renovation of existing tissues. A variation of this gene is found to be strongly associated with Achilles tendon injury.

Gene Name: BMP4 | Your Genotype: GG

The BMP4 gene encodes for a protein (bone morphogenetic protein 4), which plays a crucial role in the formation and repair of bone and cartilage. A variation of this gene is found to have a strong association with tendinopathy.

Gene Name: Near TIMP2 | Your Genotype: CT

This variant is located near the TIMP2 gene. This gene encodes for a protein (metallopeptidase inhibitor 2), which is believed to inhibit the activities of MMPs which play a role in the degradation of specific parts of cells. A variant of TIMP2 was found to be strongly associated with the risk of developing Achilles tendinopathy.

Gene Name: CASP8 | Your Genotype: GG

The CASP8 gene encodes for a proenzyme that plays a significant role in the process of cell apoptosis, which is the process of programmed cell death occurring once the cells are no longer needed. Some variations of this gene were found to have strong associations with Achilles tendinopathy.

Gene Name: GDF5 | Your Genotype: TC

People who carry a variant of this gene can have an increased risk of developing Achilles tendinopathy compared to people who do not carry this variant. The GDF5 gene is important for many processes, including tendon maintenance.

Gene Name: TNC | Your Genotype: AG

The TNC gene encodes for a protein (tenascin-C) which plays a key role in regulating certain cellular interactions. In tendons, this protein is found predominantly in the regions that are essential in transmitting intense mechanical force; it is also found around the collagen fibers. This gene is regulated by the mechanical loading in tendons and a variation of the TNC gene is found to be associated with Achilles tendinopathy.

Gene Name: COL5A1

Your Genotype: TT

The COL5A1 gene encodes for a protein found in type V collagen, which is expressed in tendons as well as ligaments. Although type V collagen has a smaller composition in the collagen structure, it performs crucial functions like regulation of fiber diameter and assembly of the fibers. This gene is considered to be a marker for Achilles tendinopathy and a variation of this gene is found to be associated with a lower risk of Achilles tendinopathy.

Do's and Don'ts

Do's

- Use running shoes that provide proper cushioning for your heel and a firm arch support to help reduce tension in the achilles tendons.
- Gently stretch your calf muscles and achilles tendons before starting a run.
- Strengthen your calf muscles through resistance training.
- Take adequate rest between practice sessions.
- Gradually increase the activity level while starting a new workout program.

Don'ts

- Avoid participating in extreme long distance running events such as marathons and ultramarathons; if you take part, approach with caution.
- Avoid using worn out shoes.
- Avoid beginning workout sessions without doing warm up.
- Avoid exercising with a sore achilles tendon.
- Avoid ending workout sessions without doing cool down stretches.

Muscle Injury

What is Muscle Injury ?

Exercise puts stress on the muscles, which leads to damage. Low level damage is essential for the muscles to grow and adapt to the exercise stimuli. However, if a muscle gets excessively damaged, it can lead to muscle strains. A strain is a contraction-induced injury in which muscle fibers tear due to extensive mechanical stress. Other muscle injuries include bruises, neuromuscular disorders, and cramps. Muscle injuries result in pain, functional loss of the involved muscle, and hence an inability to perform the particular exercise/sport. An individual's genetic profile can dictate their propensity for muscle injuries.

6.4

Muscle Injury

Interpretation

You have an elevated genetic propensity for Muscle Injury. People with such a genotype usually have muscles that can easily get injured by external trauma.

Gene Table

Gene Name: ACTN3 | Your Genotype: TT

The ACTN3 gene influences the production of a protein (α-actinin-3) which is present in fast-twitch muscle fibers, which are the kind of muscle fibers important for movement requiring power, such as weightlifting or sprinting. This protein plays a role in regulating muscle metabolism among other functions. Studies have associated variations of the ACTN3 gene with muscle injury risk.

Gene Name: CCL2 | Your Genotype: GG

The CCL2 gene encodes for a protein [chemokine (C-C motif) ligand 2 - CCL2]. This protein plays a role in cell signaling in muscles during inflammation and deficiency of this protein is associated with reduced response to acute skeletal muscle injury. Due to this gene's influence on the production of CCL2 protein, it has been associated with muscle injury risk.

Gene Name: ESR1 | Your Genotype: TC

Studies have indicated that estrogen may have protective effects on muscles, with reduced muscle damage and increased muscle regeneration following muscle injury. A variation of the ESR1 gene may be associated with muscle injuries.

Gene Name: COL5A1 | Your Genotype: TT

Although type V collagen is not found in higher quantities, it's distribution in tissues is quite extensive. It plays an important role in the regulation of fiber diameter and assembly of collagen fibers. The COL5A1 gene influences the production of α1 chain which is a component of several forms of type V collagen; type V collagen is seen in tissues that have type I collagen, e.g. tendons, ligaments.

Do's and Don'ts

Do's

- Follow Rest, Ice, Compression, Elevation (RICE), as it is the most effective treatment post injury.
- Ensure pain free movement throughout the physical activity.
- Undertake resistance training to make the muscles stronger.
- Warm up properly before physical activity.
- Work on improving your flexibility.

Don'ts

- Avoid over exerting the muscles.
- Avoid lifting very heavy weights which you are not used to lifting.
- Avoid taking very big jumps in weight increment during workouts; increase weight gradually.
- Avoid participating in competitive power/strength activities without taking proper precautions for muscle injury.

Rotator Cuff Injury

What is Rotator Cuff Injury ?

The rotator cuff is a group of four tendons that stabilize the shoulder joint. It functions in keeping the head of the upper arm bone firmly within the socket of the joint. Rotator cuff injury is the damage to the rotator cuff from a traumatic event or from repetitive shoulder joint movements as observed in many sports/exercises. This can lead to minor strain injury, partial tear of the tendons or complete tear of tendons, with loss of shoulder joint function. It manifests as a dull ache in the shoulder and pain while trying to move the shoulder joint. An individual's genetic profile can dictate their propensity for rotator cuff injury.

7.1

Rotator Cuff Injury

Interpretation

Your genetic profile indicates that you have an elevated risk for Rotator Cuff Injury. Your tendons in the rotator cuff are not genetically predisposed to withstand great physical trauma.

Gene Table

Gene Name: FGF3 | Your Genotype: GA

The FGF3 gene encodes for proteins that play a role in essential processes like cell growth and repair of tissues, including tendons. Therefore, variation in this gene can be associated with the risk of conditions affecting the rotator cuffs.

Gene Name: Near ESRRB | Your Genotype: TC

The ESRRB gene influences the production of a protein (estrogen-related receptor β), which is believed to induce the expression of other proteins in the skeletal muscles. This gene is found to have significant associations with rotator cuff disease and rotator cuff tear.

Gene Name: BMP4 | Your Genotype: GG

The BMP4 gene encodes for a protein (bone morphogenetic protein 4), which plays a crucial role in the formation and repair of bone and cartilage. A variation of this gene is found to have a strong association with tendinopathy.

Gene Name: DEFB1 | Your Genotype: GG

The DEFB1 gene encodes for a protein (defensin β1), which is believed to be significant in resisting microbes from binding to certain tissue surfaces (epithelial). A variation of this gene with rotator cuff disease.

Gene Name: FGFR1 | Your Genotype: TT

The FGFR1 gene encodes for a protein (fibroblast growth factor receptor 1) that plays a role in processes like cell growth, maturation, and wound healing. This protein triggers various reactions within cells, thereby promoting the growth and development of many parts of the body, including the long bones in the arms and legs. The FGFR1 gene is found to have a significant association with and rotator cuff disease.

Do's and Don'ts

Do's

- Optimize the technique/form involved in overhead movements, e.g. serving a tennis ball, military press exercise during shoulder workouts etc.
- Warm up and gently stretch your arms and shoulders before performing an activity which can be taxing on your shoulders.
- Strengthen your shoulder muscles through resistance training.
- Strengthen the small rotator cuff muscles which are often neglected; exercises such as dumbbell external rotation work on the rotator cuff muscles.
- Take adequate rest between activity sessions.

Don'ts

- Avoid going very heavy on exercises which put excessive strain on your rotator cuffs, e.g. behind the neck press, behind the neck lat pulldown.
- Avoid ending workout/game without doing cool down exercises.
- Avoid undertaking overhead movement activities without taking proper precautions for rotator cuff injury.

Anterior Cruciate Ligament Injury

What is Anterior Cruciate Ligament Injury ?

There are four main ligaments which connect the thigh bone to the shin bone at the knee joint, the Anterior Cruciate Ligament (ACL) is one of them. The ACL serves several functions, making it extremely essential for providing stability to the knee joint and aiding in its function. It prevents the shin bone from moving too far forward with respect to the thigh bone. It prevents excessive internal rotation of the shin bone and knee hyperextension beyond the point of maximal knee extension. Lastly, it also helps protect the knee from excessive sideways forces such as when a rugby player is tackled from the side. ACL injuries most commonly occur during activities that involve sudden stops, jumping or changes in direction, performed with improper technique. An ACL tear is one of the most common knee injuries, requiring a complex surgery with a prolonged recovery time usually ranging from 6-9 months. Therefore, gauging a person's risk for ACL injury is absolutely essential before undertaking such activities which can potentially damage the ACL.

6.0

Anterior Cruciate Ligament Injury

Interpretation

As per your genotype, you have a typical risk for Anterior Cruciate Ligament (ACL) Injury. Your genetics are such that neither do they elevate the risk for an ACL injury, nor do they provide a protective effect.

Gene Table

Gene Name: MMP12 | Your Genotype: AA

The MMP12 gene influences the production of a protein that is involved in the breakdown of extracellular matrix (provides structural, adhesive and biochemical signaling support to cells) in normal physiological as well as disease processes; it also influences the process of elastin (protein present in tissues that require elasticity) degradation. A variant of the MMP12 gene is associated with a reduced risk of non-contact ACL ruptures.

Gene Name: ACAN | Your Genotype: GT

The ACAN gene encodes for a protein (aggrecan), which is an essential component in cartilage tissues as the protein aids the tissues in withstanding compression. Studies indicate that variation of this gene may be associated with an individual's risk for anterior cruciate ligament ruptures.

Gene Name: COL1A1 | Your Genotype: GG

The COL1A1 gene encodes for and influences the production of type I collagen; type I collagen is a key component that provides strength to many tissues in the body, including ligaments. A variation of this gene was found to be strongly associated with the anterior cruciate ligament rupture.

Gene Name: COL3A1 | Your Genotype: GA

The COL3A1 gene influences the production of type III collagen, specifically the pro-α1 chains of type III collagen. In combination with type I collagen, type III collagen is found to form mixed fibrils present in elastic tissues, including ligaments and tendons. Studies have observed strong associations between a variant of the COL3A1 gene and the risk of anterior cruciate ligament ruptures.

Gene Name: COL12A1 | Your Genotype: AA

The COL12A1 gene encodes for specific chains (α1 chains of XIIA and XIIB) of certain forms of type XII collagen. Type XII collagen is one of the major components of the Anterior Cruciate Ligament (ACL) collagen, along with other types of collagen and proteins. Variants of this gene have been studied and found to be associated with ACL tears in various populations.

Gene Name: VEGFA | Your Genotype: CA

The VEGFA gene plays a role in the production of a protein that has high potency in the process of angiogenesis, which is the formation of new blood vessels. A variation of this gene has been associated with the risk of anterior cruciate ligament rupture.

Gene Name: COL5A1

Your Genotype: TT

Although type V collagen is not found in higher quantities, its distribution in tissues is quite extensive. The COL5A1 gene influences the production of the α1 chain which is a component of several forms of type V collagen. This gene was found to be positively associated with ligament injuries and one of its variants was found to increase one's predisposition for anterior cruciate ligament injuries.

Do's and Don'ts

Do's

- Perform sufficient warm up before starting to play.
- Follow warm up with stretches for your thighs, calves, and hips; pay particular attention to any areas that are especially tight.
- Perform strength exercises such as squats and lunges for the lower body so that support is provided to your knees during impact.

Don'ts

- Prevent your knees from collapsing inward when landing from a jump.
- Avoid coming to a sudden stop while landing from a jump, instead decrease your momentum gradually as you land as this will lead to lesser impact on your knees. This can be achieved by letting your knees bend softly each time you land.

Tennis Elbow

What is Tennis Elbow ?

Tennis Elbow, also known as lateral elbow tendinopathy, is a condition in which the outer part of the elbow becomes painful and tender. It occurs when tendons in the elbow are overloaded, usually by repetitive motions of the wrist and arms. It is commonly observed in people undertaking racquet sports. However, other activities eliciting such repetitive motions can also cause tennis elbow. A repetitive motion like gripping a racket during a swing can strain the muscles and put too much stress on the tendons. This constant tugging can eventually cause small tears in the tissue, leading to injury.

6.5

Tennis Elbow

Interpretation

As per your genotype, you have an elevated risk for Tennis Elbow. People with such genetics tend to have tendons in the outer part of their elbows that are not predisposed to withstand large physical trauma.

Gene Table

Gene Name: COL5A1 | Your Genotype: TT

Although type V collagen is not found in higher quantities, it's distribution in tissues is quite extensive. It plays an important role in the regulation of fiber diameter and assembly of collagen fibers. The COL5A1 gene influences the production of the α1 chain which is a component of several forms of type V collagen. Variations of this gene have been suggested to influence the risk of tennis elbow.

Do's and Don'ts

Do's

- Optimize the technique involved in the desired elbow movement, e.g. perfect your form while swinging a racquet.
- Put a strong emphasis on warmup and gently stretch your arm muscles before undertaking an activity which can be taxing on your elbows.
- Strengthen your forearm muscles through resistance training.
- Take adequate rest between practice sessions.
- Perform appropriate cool down exercises post workout/game.

Don'ts

- Avoid beginning and ending workout sessions without warm up stretching and cool down exercises.
- Avoid using a heavy racquet/equipment.
- Avoid over exerting the tendons in the elbow especially when soreness/discomfort is felt.
- Avoid undertaking racquet sports without taking proper precautions for tennis elbow.

Concussion

What is Concussion ?

Concussion is a temporary unconsciousness or confusion caused by a blow to the head or by violent shaking of the head and body. It temporarily affects brain functioning and may lead to temporary cognitive problems. Some symptoms may begin immediately, while others may appear days after the injury. Post a concussion, even after the symptoms are reversed, the neurons in the brain remain in a vulnerable state for some time, and another concussion during this period of vulnerability may lead to permanent damage to those neurons. Therefore, it is advised to take an extended period of rest even after the symptoms are reversed. Genetics play a role with respect to an individual's risk of getting concussed and the vulnerability period after a concussion.

6.9

Concussion

Interpretation

Your genetic profile dictates that you have an elevated risk for Concussion. People with such genetics tend to have a greater propensity for concussion and a slower rate of recovery from a concussed state.

Gene Table

Gene Name: | Your Genotype: AC

Gene Name: APOE | Your Genotype: TT

The APOE gene encodes for a protein that plays a role in cell repair and growth and is produced in response to injury. The gene regulates the regions which are important for memory consolidation and which are prone to damage resulting from blunt head trauma.

Gene Name: SLC17A7 | Your Genotype: CG

The SLC17A7 gene influences the production of a protein that is expressed in the neuron-rich regions of the brain. An association has been observed between the presence of a variation of the SLC17A7 gene and prolonged recovery from a concussive injury.

Gene Name: COMT | Your Genotype: GG

The COMT gene encodes for an enzyme (catechol-O-methyltransferase) which plays a role in the breakdown of various neurotransmitters. The enzyme also has a crucial role in regulating dopamine which is involved in the movement, cognition, personality, and behavior.

Do's and Don'ts

Do's

- Always wear safety headgear, whenever applicable.
- Get awareness about concussion and its symptoms, as unreported concussions can lead to permanent neuronal damage on another impact.
- Perform exercises that strengthen the neck and shoulder muscles.

Don'ts

- Avoid resuming physical activity immediately after symptoms of concussion are gone; get medical clearance before resuming activity.
- Avoid playing high impact sports such as rugby, football etc. without taking proper precautions for concussion.

Category Summary

EXERCISE RESPONSE

7.9

Resistance training and Muscle building

4.1

Muscle Damage and Recovery

4.3

Fat Loss Response to Exercise

Resistance Training And Muscle Building

What is Resistance training and Muscle building ?

Skeletal muscles, being capable of generating force, are responsible for the movement of the body. Muscles are the primary engine room for fat burning and glucose uptake. Bigger muscles require more energy and in turn burn more calories, leading to fat loss and aiding in weight management. Muscles also help in preventing diabetes as they increase insulin sensitivity and hence protect against insulin resistance. Increasing muscle mass also leads to a more toned appearance, leading to a better body image and self confidence. Other benefits of increased muscle mass include decreased injury risk, increased immunity, increased strength and energy, decreased risk of arthritis and increased metabolic efficiency. Muscle building takes place by undertaking a weight training regimen along with proper caloric surplus diet high in protein. However, muscle mass building is governed by certain genes. An individual's genetic profile can indicate how easily and to what extent a person can increase their muscle mass with training.

7.9

Resistance training and Muscle building

Interpretation

As per your genotype, your response to Resistance Training and Muscle Building is poor. People with such a genotype usually find it difficult to build muscle regardless of doing resistance training. This could possibly result in slow or no gains in muscle mass with continuous training. Concentrated effort on diet and workouts is required to maximize muscle growth.

Gene Table

Gene Name: LEPR | Your Genotype: AG

The LEPR gene encodes for a protein (leptin receptor) which is present in the hypothalamus along with other tissues including the skeletal muscles. The hormone, leptin, which binds to the receptor is believed to influence the uptake of glucose and fatty acid oxidation in skeletal muscles to prevent the accumulation of lipid (fat) in nonadipose tissues like skeletal muscles.

Gene Name: IL15RA | Your Genotype: AC

The IL15RA gene encodes for a protein (interleukin 15 receptor, alpha subunit - IL-15Rα). IL-15Rα is produced by skeletal muscle in response to different exercise; they play an important role in skeletal muscle hypertrophy (increased mass of a tissue due to an increase in cell size).

Gene Name: ACTN3 | Your Genotype: TT

The ACTN3 gene influences the production of a protein (α-actinin-3) found in fast-twitch muscle fibers, which are the kind of muscle fibers important for movement requiring power, such as weightlifting or sprinting. This protein plays a role in regulating muscle metabolism among other functions.

Gene Name: IGF1 | Your Genotype: CT

The IGF1 gene encodes for a protein (insulin-like growth factor 1) which plays a key role in the growth and development of skeletal muscles, and can also induce hypertrophy (increased mass of a tissue due to an increase in cell size) of skeletal muscles.

Gene Name: ACE | Your Genotype: AA

The ACE gene plays a role in the production of an enzyme (angiotensin II) which controls blood pressure. Certain variants of this gene can help in making better improvements during higher intensity training.

Gene Name: INSIG-2 | Your Genotype: GC

This gene encodes for Insulin induced gene 2. It is an endoplasmic reticulum protein that blocks the processing of sterol regulatory element binding proteins (SREBPs) by binding to SREBP cleavage-activating protein (SCAP). It has been functionally linked to lipid metabolism, most notably due to its role in endogenous cholesterol and fatty acid synthesis feedback inhibition.

Gene Name: MSTN | Your Genotype: GG

The MSTN gene encodes for a protein (myostatin) which is found in muscles used for movement, plays a significant role in controlling the growth and development of tissues. It regulates the growth of muscles.

Gene Name: BMP2 | Your Genotype: AA

The BMP2 gene encodes for a protein (bone morphogenetic protein 2 - BMP2) which among other functions influences the behavior of mesenchymal cells (cells that can differentiate into various cell types, including bone cells, muscle cells, fat cells, and cartilage cells). Since this protein influence the formation of muscle cells, its amount, timing, and location can influence myogenesis (formation of muscle tissue).

Gene Name: IGFBP3 | Your Genotype: AC

The IGFBP3 gene encodes for a protein (insulin-like growth factor-binding protein 3), which exists in the skeletal muscles, binds to IGF1 or IGF2, enabling their function of regulating skeletal muscle growth. Most of the circulating IGF1 is bound by IGFBP-3 thus influencing the effects of IGF1 on skeletal muscles. Variation in the IGFBP3 gene has been known to influence the levels of IGFBP3 protein which in turn regulates the activity of IGF1.

Gene Name: TRHR | Your Genotype: GT

The TRHR gene encodes for a hormone receptor, which is the receptor to which the thyrotropic-releasing hormone (TRH) binds. The binding of TRH to the receptor results in various cellular signals which stimulate the thyroid gland to produce a hormone that is crucial in regulating the growth and development of skeletal muscles. Variation of this gene can interfere with the activity of TRH binding, which can further affect muscle-building post-training.

Do's and Don'ts

Do's

- Undertake weight training at least 5 days a week as this is recommended in order to gain muscle mass.
- Perform multiple muscle group splits as they will be more beneficial. Hit each muscle group twice a week.
- Try to have 5-6 equally spaced out protein rich meals each day so that your muscles do not go into a state of catabolism.
- Eat a protein rich meal for breakfast so as to fuel the muscles after a night long fast.
- Maintain a caloric surplus diet.

Don'ts

- Avoid excessive cardio while trying to lose weight.
- Avoid decreasing protein intake on rest days.
- Avoid neglecting complex carbohydrates and healthy fats.
- Avoid focussing on isolation exercises instead of compound exercises.

Muscle Damage And Recovery

What is Muscle Damage and Recovery ?

Exercise leads to muscle damage. While excessive muscle damage is detrimental, muscle damage to a small extent is essential for its growth and adaptation to the exercise stimuli. Muscle damage leads to an inflammatory response which repairs the muscle and aids in its growth and adaptation. This inflammation manifests itself as muscle soreness. Soreness is the feeling of pain and stiffness while using the muscle, thereby making day to day movements uncomfortable. Putting excessive stress on a sore muscle can lead to an injury. Therefore, it is imperative to understand an individual's propensity for muscle damage after a workout and the rate of recovery from that damage, which would dictate the intensity of workouts and the ideal amount of rest that should be taken between two workouts. Interplay of many genes and the variations in them dictate the muscle damage and recovery response.

4.1

Muscle Damage and Recovery

Interpretation

As per your genotype, your Muscle Damage and Recovery profile is typical. People with such a genotype usually have a typical extent of muscle damage on exercise and an average rate of recovery from workouts. This could only allow for an average volume of workout and increased rest periods between workouts.

Gene Table

Gene Name: MCT1 | Your Genotype: AA

The MCT1 gene encodes for a protein (monocarboxylate transporter 1), which influences the transport of lactate across membranes, to produce ATP, the energy currency for cells. This is an important process for cell metabolism, including that of skeletal muscles. Defects in lactate transporter in skeletal muscles may cause fatigue and muscle cramping during exercise. Variants of the MCT1 gene can influence the onset of fatigue. Expression of MCT1 in muscles can help to offset fatigue; increased MCT1 expression may imply a reduced likelihood of experiencing fatigue easily.

Gene Name: CRP | Your Genotype: TT

The CRP gene encodes for a protein (C-reactive protein), which is has been linked to defense mechanisms owing to its ability to recognize damaged host cells and to initiate their elimination. During the acute phase of injury response, the level of this protein in the blood is elevated; the concentration of CRP is a common exercise recovery marker.

Gene Name: TRIM63 | Your Genotype: AA

The TRIM63 gene encodes for a protein (muscle RING finger 1 - MuRF-1), which plays a role in maintaining muscle protein homeostasis. Variation in the gene can alter the structure of MuRF-1, which can decrease the stiffness of muscle fibers which can lead to an increased susceptibility to exercise-induced muscle damage.

Gene Name: IGF2 | Your Genotype: AA

The IGF2 gene encodes a protein (insulin-like growth factor 2 - IGF2) which has a structure similar to that of insulin structurally similar to insulin; it plays a role in fetal growth and development and is crucial for skeletal muscle growth and differentiation. Variations in the IGF2 gene have been linked with reduced muscle strength following muscle damage.

Gene Name: Near IGF2AS | Your Genotype: TT

This variant is situated near the IGF2AS gene. The IGF2AS gene is expressed in antisense to the insulin-like growth factor 2 (IGF2). It is known to have growth-regulating and insulin-like activities. IGF2 has been shown to be upregulated in response to the damage induced by muscle contraction and therefore plays a key role in recovery from muscle damage. IGF2AS is antisense to the IGF2 gene and hence is believed to play a role in the regulation of IGF2.

Gene Name: ACTN3 | Your Genotype: TT

The ACTN3 gene influences the production of a protein (α-actinin-3) found in fast-twitch muscle fibers, which are the kind of muscle fibers important for movement requiring power, such as weightlifting or sprinting. This protein plays a role in regulating muscle metabolism among other functions.

Gene Name: COL2A1 | Your Genotype: GG

The COL2A1 gene encodes for a protein (collagen type II, alpha 1), which provides structure and strength to connective tissues, which support muscles, joints, organs, and skin. Variation in the COL2A1 gene has been associated with muscle strength and recovery after exercise-induced muscle damage due to its effect on collagen network dysregulation which can have a negative effect on the mechanical properties of the muscle-tendon unit.

Gene Name: ACE | Your Genotype: AA

The ACE gene plays a role in the production of an enzyme (angiotensin-converting enzyme - ACE), which is expressed in several tissues, including skeletal muscles; it may play a key role in metabolism during exercise. ACE is important for producing angiotensin II which is a vasoconstrictor, which influences metabolism and hypertrophy of skeletal muscle in response to exercise. A variation in the ACE gene may also influence activity and levels of creatine kinase in response to eccentric contractions (muscle lengthening), thereby affecting exercise-induced muscle injury.

Gene Name: Near CCL2 | Your Genotype: CC

This variant is located near the CCL2 gene. In the days after performing intense exercise/activities, there is an infiltration of macrophages into the damaged tissue. The CCL2 gene encodes for a protein [chemokine (C-C motif) ligand 2], which plays a key role in satellite cell and macrophage signaling in muscle tissue during inflammation. The process of infiltration of satellite cells and macrophages are crucial for muscle repair. Variants of the CCL2 gene were associated with soreness, the outflow of creatinine kinase after exercise, and recovery of strength. This influence of the gene was found to be related to a particular time period (4 –10 days after exercise) when the muscle repair process peaks.

Gene Name: MLCK | Your Genotype: CA

The MLCK gene encodes for a protein (myosin light chain kinase), which affects myosin (a motor protein which has a key role in muscle contraction) and influences the force produced during muscle contraction. The variation in the MLCK gene can affect the force produced in muscles; decreased ability to resist strain during voluntary muscle contractions can lead to muscle damage.

Gene Name: CCR2 | Your Genotype: CC

The CCR2 gene encodes for a protein (C-C chemokine receptor type 2), which is key for signaling of macrophages and satellite cells in muscle tissue during inflammation. CCR2 acts as a receptor for certain proteins including CCL2 protein. Variants of the CCR2 gene were associated with soreness, the outflow of creatinine kinase after exercise, and recovery of strength. This influence of the gene was found to be related to a particular time period (4 –10 days after exercise) when the muscle repair process peaks.

Gene Name: SOD2 | Your Genotype: TT

Oxidative stress produced during intense exercise is associated with muscle damage and metabolism, which can lead to decreased physical performance and muscle damage. The SOD2 gene encodes for a protein (superoxide dismutase) which helps in creating an antioxidant that plays a key role in energy production within the cells by preventing excess damage to the cells caused by free radicals. It also helps in reducing oxidative stress. A variation in the SOD2 gene can influence the efficiency of this process.

Gene Name: IL6 | Your Genotype: GG

The IL6 gene helps in the production of interleukin-6 (IL-6), a molecule that plays a key role in the immune system, athletic performance, and muscle recovery. During exercise recovery, muscles tend to release IL-6 due to skeletal muscle damage, which may result in increased levels of IL-6 in the blood, which is a process similar to inflammatory response during injury or infection.

Gene Name: SLC30A8 | Your Genotype: CC

The SLC30A8 gene encodes a protein (zinc efflux transporter 8 protein), which is a zinc transporter primarily expressed in the pancreas (α-cells and β-cells). Skeletal muscle and β-cell interactions play a role in healthy skeletal muscle function and mass. The SLC30A8 gene may play a role in the communication between myokines (secretory molecules from skeletal muscle) and β-cell function and therefore, a variant in this gene could have an influence over the skeletal muscle size and strength.

Gene Name: COL5A1

Your Genotype: TT

Although type V collagen is not found in higher quantities, it's distribution in tissues is quite extensive. It plays an important role in the regulation of fiber diameter and assembly of collagen fibers. The COL5A1 gene influences the production of α1 chain which is a component of several forms of type V collagen; type V collagen is seen in tissues that have type I collagen, e.g. tendons, ligaments. Therefore, in non-cartilage connective tissue, COL5A1 molecules along with type I collagen fibers regulate the development of fibrils in collagen fibers. Since the severity of muscle injuries can be influenced by the collagen composition, variation in the COL5A1 gene may be associated with the severity of muscle injuries.

Do's and Don'ts

Do's

- Keep a moderate frequency of workouts for up to 5 days a week.
- Design workouts with moderate to moderately high volume.

Don'ts

- Avoid excessive high intensity interval training.
- Avoid improper exercise form.
- Avoid improper nutrition as it can hamper recovery.

Fat Loss Response To Exercise

What is Fat Loss Response to Exercise ?

Fat is stored in our body in the form of triglycerides in adipose tissues. During exercise, triglycerides are broken down into free fatty acids and transported to the muscles where they are oxidised to generate energy. This process leads to fat loss. Regular exercise renders weight control through oxidation of fats and improved metabolism. Losing fat helps in cultivating a positive body image and also leads to a decreased risk of health problems such as diabetes, heart diseases, arthritis, high blood pressure, and cancer. How efficiently people respond to exercise in terms of breaking down of triglycerides, transportation of free fatty acids, and subsequently, oxidation of these fatty acids depends on their genetics.

4.3

Fat Loss Response to Exercise

Interpretation

As per your genotype, your Fat Loss Response to Exercise is typical. People with such a genotype usually show an average response of using fat as an energy source during workouts. Their metabolism tend to not preferentially rely on their fat stores for energy generation.

Gene Table

Gene Name: UCP3 | Your Genotype: CC

Uncoupling proteins (UCPs) play a role in energy expenditure, thermogenesis (production of body heat), regulation of free fatty acids, and reduction of reactive oxygen species (buildup of such molecules can be harmful). The UCP3 gene encodes for a protein (mitochondrial uncoupling protein 3 - UCP3), which is selectively expressed in skeletal muscles. UCP3 is involved in regulating energy metabolism, weight control, and in modulating the use of fat and glucose for energy generation.

Gene Name: CPT1B | Your Genotype: GG

The CPT1B gene encodes for a protein (carnitine palmitoyltransferase IB - CPT1B), which plays a significant role in fat metabolism. Variations in the gene can affect CPT1B protein which may influence exercise recovery, weight gain, and weight-loss following exercise.

Gene Name: PPARGC1A | Your Genotype: AG

The PPARGC1A gene plays a role in the production of a protein that has beneficial effects on the body, following exercise. Acute exercise activates this protein, which in turn regulates the expression of genes involved in fat and carbohydrate metabolism, among other functions. Variations of the PPARGC1A gene have been associated with various conditions like type 2 diabetes, insulin resistance, glucose concentrations, obesity, aerobic fitness, and regular physical activity. A specific genotype has found to be associated with increased anaerobic threshold, slow muscle fibers, and reduction of total cholesterol and low-density lipoprotein (LDL) following lifestyle interventions including regular aerobic training. Therefore, this variant of the gene is believed to influence the efficiency of aerobic metabolism.

Gene Name: ADRB2 | Your Genotype: AG

A variation in the ADRB2 gene was shown to alter the structural properties of a protein that may eventually affect lipolysis (the breakdown of fats to release fatty acids).

Gene Name: PPARD | Your Genotype: AA

The PPARD gene encodes for a protein that can affect energy production. In muscle tissues, the expression of this gene is increased due to exercise, which can result in increased fat burning capacity. Variations in the PPARD gene can regulate training-induced body mass changes, along with glucose levels, and fat profile. Studies show that a variant of this gene may result in a lesser decrease in body mass after training, which may prove to be unfavorable for the purpose of achieving the desired training-induced body mass changes.

Gene Name: CD36 | Your Genotype: AA

The CD36 gene encodes for a protein (fatty acid translocase - CD36). While exercising, there is an increase in the mobilization of fatty acids from the bloodstream to the tissues, especially to the skeletal muscles, for its uptake and subsequent oxidation. CD36 plays a key role in aiding cellular uptake and utilization of fatty acid, particularly in fat cells, which eventually influences energy storage and mobilization.

Gene Name: Near LEP | Your Genotype: AA

This variant is located near the LEP gene. The LEP gene encodes for a hormone, leptin, which is primarily expressed in fat tissue. Leptin plays a key role in regulating energy expenditure and appetite suppression.

Gene Name: LPL | Your Genotype: AA

The LPL gene encodes for a protein (lipoprotein lipase) which plays a significant role in directing fatty acids toward adipose (fat) and muscle tissues. A variant of the LPL gene was found to influence exercise training-induced changes in body fat.

Gene Name: ADRB3 | Your Genotype: AA

The ADRB3 gene encodes for a protein (β3-adrenergic receptor - β3-ADR), which is mainly located in the fat tissue and to a certain extent in the muscle tissue. This protein plays a role in regulating fat breakdown and production of body heat. Variations in the gene can affect the function of β3-ADR; reduced function can slow down the mobilization of fats and may cause retention of fats in the cells. Moreover, the production of body heat can have an influence on body weight.

Do's and Don'ts

Do's

- Focus equally on exercise and diet plan.
- Eat foods rich in protein and fiber, which makes you feel full and stave off hunger.
- Include cardio exercises at least 3 times a week.
- Undertake weight training at least 3 times a week to improve metabolism.
- Maintain a caloric deficit diet.

Don'ts

- Avoid consuming high calorie meals such as fried foods.
- Avoid consuming empty calories such as sweetened aerated beverages.
- Avoid favouring low intensity cardio instead of high intensity cardio.

Category Summary

FLEXIBILITY

5.0

Flexibility

Flexibility

What is Flexibility ?

Flexibility is the ability to move effectively through a complete range of motion in a joint. Flexibility is determined by the gender, age, training levels, temperature, and elasticity of the tissues surrounding a joint, namely, ligaments, tendons, and muscles. Improved flexibility allows for better performance when playing sports or exercising. It also adds to the level of comfort in day to day activities such as bending, walking, and lifting. The elasticity of the tissues involved is controlled by the protein collagen, providing the genetic linkage to flexibility.

5.0

Flexibility

Interpretation

Your genetic profile indicates that you have typical Flexibility. People with such genetics usually have a musculoskeletal system which has no predisposition to be less or more flexible than average.

Gene Table

Gene Name: ACTN3 | Your Genotype: TT

The ACTN3 gene influences the production of a protein (α-actinin-3) found in fast-twitch muscle fibers, which play a role in producing explosive muscle contractions. Along with the regulation of muscle strength, the ACTN3 gene also has an effect on flexibility and muscle stiffness. A variation of this gene has been shown to result in reduced flexibility.

Gene Name: COL5A1 | Your Genotype: TT

The COL5A1 gene encodes for the protein (collagen type V α1 chain), which is found in ligaments, tendons, and other tissues containing type I collagen. This gene is known to affect skeletal muscle tissue and variations of this gene are found to influence muscle stiffness and joint flexibility.

Do's and Don'ts

Do's

- Perform stretching workouts to improve flexibility.
- Perform warm up exercises before stretching workouts, such as a light 10-15 minute jog.
- Perform dynamic stretches before static stretches.
- Perform yoga and/or pilates.

Don'ts

- Avoid overstretching as this can lead to dislocation, muscle pulls, tendon/ligament injuries, etc.
- Avoid improper exercise form since this can lead to injuries.