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Diabetes and Obesity

Client

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Diabetes

Diabetes, a chronic condition characterized by elevated blood glucose levels, includes several types, most notably Type 2 Diabetes (T2D). Both forms of diabetes are influenced by genetic factors that affect their development and progression. Understanding the genetic predispositions to diabetes can provide valuable insights into risk assessment, prevention strategies, and personalized treatment approaches. This section examines the genetic underpinnings of diabetes, highlighting how genetic variability contributes to disease risk and management.

T2D is primarily associated with insulin resistance and is influenced by both genetic and lifestyle factors. Genetic studies have identified numerous loci associated with T2D risk, with genes affecting insulin secretion, insulin action, and glucose metabolism. Notable genes include *TCF7L2*, which influences insulin secretion and glucose production, and *PPARG* and *FTO*, which are involved in fat metabolism and appetite regulation. Understanding these genetic interactions helps in identifying individuals at high risk and tailoring preventive measures such as dietary modifications, physical activity, and early pharmacological intervention.

Beyond T1D and T2D, there are forms of diabetes that result from mutations in a single gene, known as monogenic diabetes, which includes neonatal diabetes and maturity-onset diabetes of the young (MODY). Identifying specific genetic mutations responsible for monogenic diabetes can lead to highly specific treatments, such as using sulfonylureas in patients with mutations in the *KCNJ11* gene, which encodes the Kir6.2 subunit of the potassium channel in pancreatic beta cells.

Genetic testing can enhance the management of diabetes by identifying individuals with a predisposition to the disease and by tailoring treatment approaches to the individual's genetic profile. For T2D, this may involve selecting medications that target specific pathways affected by the patient's genetic makeup. For T1D, understanding genetic risk can inform strategies for early detection and possible intervention to delay or prevent the onset of disease.



Insulin Resistance Propensity (New)



Neutral

Understanding what this may mean

Individuals with this genetic result have a neutral risk of insulin resistance. Their genetic profile suggests a standard likelihood of developing insulin resistance, which can be influenced by various factors including diet, physical activity, and overall health. It is important for individuals with this result to focus on maintaining a healthy lifestyle, including a balanced diet, along with regular physical activity, to support insulin sensitivity and metabolic health.

Adiponectin Levels



Neutral

Understanding what this may mean

Those with a typical adiponectin level exhibit average hormonal balance, aligning with the general population's metabolic health. This level supports standard metabolic functions, including normal glucose regulation and fat metabolism. Maintaining a healthy lifestyle, including regular exercise and a balanced diet, can support adiponectin levels and potentially enhance metabolic health.

Leptin Propensity



Neutral

Understanding what this may mean

Individuals with a neutral leptin propensity have genetic markers that indicate a typical response to leptin, a hormone primarily involved in regulating hunger and energy balance. This average response suggests that their risk of developing leptin resistance, which can lead to difficulties in managing appetite and body weight, is similar to that of the general population. Maintaining a healthy lifestyle, including a balanced diet and regular physical activity, is recommended to support effective leptin function and overall metabolic health. Monitoring for signs of weight gain or abnormal hunger levels can help in early identification and management of potential leptin sensitivity issues

T2D Propensity



Caution

Understanding what this may mean

Those identified with a caution risk for Type 2 diabetes have genetic markers that slightly increase their susceptibility to developing diabetes. This elevated risk indicates the importance of being vigilant about diet and lifestyle choices to manage their predisposition. Measures such as reducing sugar and refined carbohydrates in the diet, increasing physical activity, and regularly monitoring blood sugar levels can be effective in preventing or delaying the onset of diabetes.

Genetic Summary ³¹

SNP	Marker	Genotype
PCSK9 G137T	rs11591147	GG
TCF7L2 T450+29705C	rs7901695	TC
PPARG C1341T	rs3856806	CC
MC4R (T>C)	rs17782313	TC
CDKAL1 (T>C)	rs10811661	TT
CDKAL1 T487C	rs564398	TT
CDKAL1 A371+30101G	rs7756992	GG
CDKAL1 G371+11642C	rs7754840	CC
CDKAL1 A371+11426C	rs10946398	CC
KCNQ1 C1795-29246T	rs2237892	TC
IGF2BP2 A239+11861C	rs1470579	AA
ABCC8 C4105A	rs757110	AC
KCNJ11 T67C	rs5219	TC
HHEX (G>A)	rs7923837	GG

SNP	Marker	Genotype
ADCY5 A1406+851G	rs11708067	AA
GCK (G>A)	rs4607517	GG
GCK C-30T	rs1799884	CC
GCKR T1423-418C	rs780094	TC
MTNR1B C223+5596G	rs10830963	CC
SLC30A8 C973T	rs13266634	CC
TCF7L2 G552+9017T	rs12255372	GG
TCF7L2 C450+33966T	rs7903146	CC
ADIPOQ G-9+3481A	rs822396	AG
ADIPOQ T45G	rs2241766	TT
ADIPOQ G-60+244A	rs182052	GG
ADIPOQ T331C	rs17366743	TT
ADIPOQ G276T	rs1501299	GG
ADIPOQ g.G4012C	rs266729	CC

IRS1 (T>C)

rs2943641

TC

PPM1K (C>T)

rs1440581

TT

ADIPOQ G3998A

rs17300539

GG

Insulin Resistance

Insulin resistance is a condition characterized by the body's reduced response to the hormone insulin, leading to impaired glucose metabolism and an increased risk of developing type 2 diabetes. This section explores genetic predispositions for insulin resistance and provides insights into risk factors.

Insulin resistance can be influenced by a combination of genetic and lifestyle factors. Understanding the genetic risk for insulin resistance can help make informed decisions about diet, exercise, and overall lifestyle to reduce risk.

Genetic variations can affect how your body processes and responds to insulin. Some individuals may have a genetic predisposition for increased insulin resistance, meaning they may be more prone to developing insulin resistance even with normal or moderate levels of body fat. Others may have a lower genetic risk for insulin resistance, but lifestyle factors such as poor diet and lack of physical activity can still contribute to the development of this condition.

By knowing genetic predispositions for insulin resistance, proactive steps can be taken to reduce risk. Adopting a healthy lifestyle that includes a balanced diet, regular exercise, stress management, and adequate sleep can help improve insulin sensitivity and reduce the likelihood of developing insulin resistance.

It's important to note that genetics is just one aspect of insulin resistance, and lifestyle factors play a significant role in its development. By combining genetic insights with other clinical assessments and professional guidance, a comprehensive plan can be created to manage insulin resistance risk and promote overall health and well-being.



Insulin Resistance Propensity (New)



Neutral

Understanding what this may mean

Individuals with this genetic result have a neutral risk of insulin resistance. Their genetic profile suggests a standard likelihood of developing insulin resistance, which can be influenced by various factors including diet, physical activity, and overall health. It is important for individuals with this result to focus on maintaining a healthy lifestyle, including a balanced diet, along with regular physical activity, to support insulin sensitivity and metabolic health.

Genetic Summary ¹⁵

SNP	Marker	Genotype
ADIPOQ G3998A	rs17300539	GG
IL6/IL6-AS1 (G>C)	rs1800795	CC
ABCC8 C4105A	rs757110	AC
GLP1R G502A	rs6923761	GG
IRS1 (T>C)	rs2943641	TC
IRS1 C2911T	rs1801278	CC
GPRC6A A271G	rs2274911	AA

SNP	Marker	Genotype
NAT2 A803G	rs1208	AG
IGF1 A26G	rs35767	GG
DIO2 T274C	rs225014	TC
GCK C-30T	rs1799884	CC
GCKR T1423-418C	rs780094	TC
PPARG C34G	rs1801282	CG
PPM1K (C>T)	rs1440581	TT

MTNR1B C223+5596G

rs10830963

CC

Obesity Risk

This section focuses on understanding the complex interplay between genetic predispositions and environmental factors that contribute to the risk of developing obesity. This condition, characterized by excessive fat accumulation, poses significant health risks, including heart disease, diabetes, and hypertension.

Genetic Influences: Genetics play a crucial role in determining an individual's susceptibility to obesity. Variations in genes related to appetite regulation, energy metabolism, fat storage, and insulin signaling can significantly influence body weight and fat distribution. This segment delves into specific genetic markers that have been linked to increased obesity risk, providing insight into the hereditary aspects of weight management.

Environmental and Lifestyle Factors: While genetics set the groundwork for obesity risk, environmental and lifestyle factors such as diet, physical activity, sleep patterns, and stress levels heavily modify the expression of genetic predispositions. This section examines how external factors interact with genetic makeup to influence obesity outcomes, emphasizing the importance of a balanced lifestyle for weight management.

Personalized Prevention and Management: Acknowledging the genetic and environmental roots of obesity allows for more personalized approaches to prevention and management. Tailored dietary recommendations, customized exercise programs, and behavioral modifications can be more effectively designed with an understanding of an individual's unique genetic background and lifestyle.



Obesity Risk



Low

Understanding what this may mean

Individuals with a low genetic risk for obesity have a significantly reduced likelihood of developing obesity compared to the average population. This advantageous genetic predisposition suggests a lower tendency towards weight gain under typical dietary and physical activity conditions. Despite this genetic advantage, maintaining a balanced diet and regular exercise regimen is still important for overall health and well-being.

Weight Regain Propensity



Neutral

Understanding what this may mean

Individuals with a neutral propensity for weight regain have genetic markers that align with the average population's likelihood of regaining weight after losing it. This indicates that their genetic makeup does not significantly sway their risk either way, making lifestyle choices and behavior modifications crucial in maintaining long-term weight loss. Maintaining weight loss typically requires continuous adherence to a balanced diet, regular physical activity, and ongoing behavior changes. Individuals are encouraged to monitor their eating habits, engage in consistent exercise, and perhaps seek support from nutrition and fitness professionals to help sustain weight loss.

Genetic Summary ¹²

SNP	Marker	Genotype
LEP g.G2453A	rs7799039	GG
ADIPOQ G276T	rs1501299	GG
FTO T46-23525A	rs9939609	TT
APOA5 G*158A	rs662799	AA
TCF7L2 C450+33966T	rs7903146	CC
ADIPOQ G3998A	rs17300539	GG

SNP	Marker	Genotype
ADIPOQ G-9+3481A	rs822396	AG
MTNR1B C223+5596G	rs10830963	CC
PPARG C34G	rs1801282	CG
FTO G46-25592T	rs3751812	GG
IL6/IL6-AS1 (G>C)	rs1800795	CC
MC4R (T>C)	rs17782313	TC

Hunger and Fullness Sensing (new)

Understanding the body's hunger and fullness signals is crucial for maintaining a healthy relationship with food and managing appetite effectively.

Hunger and fullness sensing refers to the body's ability to detect and respond to its nutritional needs. Some individuals may have a genetic propensity for heightened hunger sensitivity, experiencing more intense feelings of hunger and a stronger drive to eat. Others may have a genetic predisposition for reduced appetite sensing, meaning they may be more prone to .

Additionally, emotional eating, which is the tendency to turn to food for comfort or as a response to emotional triggers, can also be influenced by genetic factors. Some individuals may have a higher genetic predisposition for emotional eating, making them more susceptible to using food as a coping mechanism for emotional stressors.

By understanding genetic tendencies related to hunger and fullness sensing, as well as emotional eating patterns, strategies can be developed to manage appetite, make informed food choices, and develop healthier relationships with food.

It's important to note that while genetics play a role in hunger and fullness sensing, other factors such as lifestyle, stress levels, and eating habits also contribute to appetite control. By adopting a balanced and nourishing diet, practicing mindful eating, and seeking support from healthcare professionals or coaches, it is possible to develop healthier habits and achieve more balanced relationships with food.



Leptin Propensity



Neutral

Understanding what this may mean

Individuals with a neutral leptin propensity have genetic markers that indicate a typical response to leptin, a hormone primarily involved in regulating hunger and energy balance. This average response suggests that their risk of developing leptin resistance, which can lead to difficulties in managing appetite and body weight, is similar to that of the general population. Maintaining a healthy lifestyle, including a balanced diet and regular physical activity, is recommended to support effective leptin function and overall metabolic health. Monitoring for signs of weight gain or abnormal hunger levels can help in early identification and management of potential leptin sensitivity issues

Snacking/Emotional Eating Risk



Neutral

Understanding what this may mean

Individuals with this genetic result have a lower risk of snacking or engaging in emotional eating behaviors. They are less likely to turn to food as a coping mechanism in response to emotions or stress. This genetic profile suggests a stronger ability to regulate and manage cravings, reducing the likelihood of excessive snacking. Maintaining a balanced diet and implementing healthy coping strategies, such as practicing mindfulness or engaging in physical activity, can further support overall well-being.

Appetite/Fullness Sensing



At Risk

Understanding what this may mean

Individuals with this genetic result may have lower than average appetite and fullness sensing. Appetite sensing plays a crucial role in maintaining a healthy balance of food intake. When appetite sensing is low, it can be challenging to accurately gauge hunger and fullness cues, potentially leading to overeating or inadequate nutrition. Paying closer attention to portion sizes and establishing regular eating patterns can be beneficial for individuals with below average appetite sensing.

Genetic Summary ¹⁰

SNP	Marker	Genotype
LEP g.G2453A	rs7799039	GG
CLOCK A*213G	rs1801260	AG
ARNTL T671-305G	rs11022778	TG
APOA2 A-265G	rs5082	AA
PER2 G-12C	rs2304672	GG

SNP	Marker	Genotype
PER2 T-159+3520C	rs4663302	TC
MC4R (T>C)	rs17782313	TC
FTO T46-23525A	rs9939609	TT
ANKK1 G2137A	rs1800497	GG
COMT G472A	rs4680	AA

Carbohydrates (new)

The role of carbohydrates in weight management has been a topic of interest and discussion in the field of nutrition. This section explores genetic variations that may influence individual responses to low-carbohydrate diets, specifically in terms of weight loss.

Low-carbohydrate diets restrict the intake of carbohydrates, typically focusing on higher protein and fat consumption. While these diets have shown promise for weight loss in some individuals, it's important to understand that individual responses can vary based on genetic factors.



Some individuals may have a genetic predisposition that makes them more responsive to low-carbohydrate diets, leading to more significant weight loss. These individuals may experience improved body composition and metabolic markers when following a low-carb approach.

On the other hand, some individuals may have a genetic profile that makes them less responsive to low-carbohydrate diets for weight loss. They may not experience the same level of success or may even find it challenging to adhere to these dietary restrictions.

Understanding genetic tendencies related to carbohydrate metabolism and weight loss can provide valuable insights into the potential effectiveness of a low-carbohydrate diet. However, it's essential to note that individual responses to any diet can be influenced by multiple factors, including overall calorie intake, nutrient balance, lifestyle factors, and personal preferences.

Weight Loss from Low-Carb Diet



Low

Understanding what this may mean

Individuals with this genetic result may experience a lower response to weight loss from a low-carbohydrate (low-carb) diet. Genetic variations associated with this result suggest that their bodies may not efficiently respond to the weight loss benefits typically observed in others following a low-carb diet. It is important for individuals with this result to explore other dietary approaches or consider seeking guidance from healthcare professionals or registered dietitians to find a weight loss strategy that suits their specific needs and genetic profile.

Complex Carb Utilization



Neutral

Understanding what this may mean

Those with a typical ability to utilize complex carbohydrates have an average efficiency in processing and extracting energy from these nutrients, similar to the general population. Complex carbs are essential for providing sustained energy, supporting digestive health, and maintaining stable blood sugar levels. Including a variety of complex carbohydrates in the diet, alongside proteins and healthy fats, can support overall health and well-being. Regular physical activity can also enhance metabolic health, complementing a balanced diet.

Glucose Metabolism



Neutral

Understanding what this may mean

Those with neutral glucose metabolism exhibit genetic markers that reflect the average population's ability to metabolize glucose. This indicates a standard efficiency in processing blood sugar, with lifestyle and dietary habits playing a significant role in maintaining healthy glucose levels. Individuals with this predisposition are advised to follow a healthy lifestyle, including regular exercise, a balanced diet, and regular medical check-ups, to support optimal glucose metabolism and prevent metabolic disorders

Caffeine Effects on Glucose



Neutral

Understanding what this may mean

Those with a neutral response to caffeine exhibit genetic markers that indicate their postprandial glucose levels are not significantly affected by caffeine intake. This means their glucose metabolism remains stable after consuming caffeine, aligning with the general population who do not experience adverse glucose responses. Individuals with this genetic makeup can generally consume caffeine without worrying about immediate detrimental effects on blood sugar control. However, it's always good practice to observe how one's body reacts to caffeine and maintain a balanced diet to support overall metabolic health.

Insulin Resistance Propensity (New)



Neutral

Understanding what this may mean

Individuals with this genetic result have a neutral risk of insulin resistance. Their genetic profile suggests a standard likelihood of developing insulin resistance, which can be influenced by various factors including diet, physical activity, and overall health. It is important for individuals with this result to focus on maintaining a healthy lifestyle, including a balanced diet, along with regular physical activity, to support insulin sensitivity and metabolic health.

Genetic Summary ²⁰

SNP	Marker	Genotype
ADORA2A T1083C	rs5751876	TC
CYP1A2 C-163A	rs762551	AA
KCNJ11 T67C	rs5219	TC
PPARG2 C-76-681G	rs10865710	CG
ADIPOQ G-9+3481A	rs822396	AG
GCK (G>A)	rs4607517	GG
MTNR1B C223+5596G	rs10830963	CC

SNP	Marker	Genotype
PPM1K (C>T)	rs1440581	TT
PPARG C34G	rs1801282	CG
PLIN1 C772-799T	rs894160	CC
IRS1 (T>C)	rs2943641	TC
GCKR T1423-418C	rs780094	TC
GCK C-30T	rs1799884	CC
FTO T46-23525A	rs9939609	TT

NAT2 A803G	rs1208	AG
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FTO T46-39685G	rs17817449	TT
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UCP3 G-238A	rs1800849	AG
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DIO2 T274C	rs225014	TC
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CETP C861T	rs5883	CC
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BDNF C196T	rs6265	TT
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Cardiovascular Genetics

Cardiovascular genetics focuses on understanding how genetic variations influence the risk, progression, and treatment responses of cardiovascular diseases (CVD), including heart disease, stroke, hypertension, and arrhythmias. This section explores the critical role of genetics in cardiovascular health, offering insights into the identification, prevention, and management of genetic predispositions to cardiovascular conditions. Several genes have been identified as playing pivotal roles in cardiovascular health.

Variations in genes related to lipid metabolism, blood pressure regulation, coagulation pathways, and inflammation can significantly impact an individual's risk of developing CVD. For example, variations in the APOE gene can influence cholesterol metabolism and CVD risk.

Advancements in cardiovascular genetics are paving the way for innovative therapies, including gene editing and gene therapy approaches targeting the root genetic causes of some cardiovascular diseases. These cutting-edge treatments offer hope for conditions previously deemed challenging to manage, providing a glimpse into the future of personalized cardiovascular care.



CAD Propensity



Increased

Understanding what this may mean

Individuals identified with an increased risk for coronary artery disease possess genetic variations that elevate their susceptibility to CAD beyond the typical population level. This heightened genetic predisposition underscores the importance of proactive cardiovascular health management. Key strategies include adopting a heart-healthy lifestyle, such as following a diet low in saturated fats and high in fiber, engaging in regular exercise, avoiding smoking, and regularly monitoring heart health metrics with healthcare providers. Early intervention and lifestyle modifications can be crucial in managing and mitigating the elevated risk of CAD.

APOe Status



APOe 3/4 status

Understanding what this may mean

Individuals with this APOe status have one copy of the APOe3 allele and one copy of the APOe4 allele. This genetic combination is associated with a higher risk of developing certain age-related conditions compared to individuals with other APOe status. It is important for individuals with this APOe status to focus on brain health by adopting beneficial lifestyle habits, including regular physical and mental exercise, and limiting risk factors for APOe 4 including saturated fat and alcohol consumption, and avoiding smoking.

Atrial Fibrillation



Increased Risk

Understanding what this may mean

Those identified with an increased risk have a 40-70% higher genetic likelihood of developing atrial fibrillation compared to the typical risk level. This elevated risk suggests a greater chance of experiencing irregular heart rhythms, warranting closer monitoring and potentially early intervention to manage heart health effectively

LP(a) Risk



Increased

Understanding what this may mean

This result corresponds with one LP(a) variant, which can result in up to 2x cardiovascular risk over time. Consider testing LP(a) blood levels to verify.

Genetic Summary ¹³

SNP	Marker	Genotype
APOE C388T	rs429358	TC
APOE C526T	rs7412	CC
LP(a) A3947+467G	rs10455872	AG

SNP	Marker	Genotype
IL6/IL6-AS1 (G>C)	rs1800795	CC
APOC4 (T>C)	rs10413089	TT
ICAM1 A1405G	rs5498	AA

LP(a) T5673C	rs3798220	TT
4q25-1	rs2200733	CC
4q25-2	rs10033464	TG
CETP G1264A	rs5882	AA

IL37 A124G	rs3811047	.
APOA2 (G>T)	rs3813627	TG
CDKN2A (A>G) / 9p21	rs10757278	GA

Metabolic Syndrome

Metabolic Syndrome is a cluster of conditions that occur together, increasing the risk of heart disease, stroke, and type 2 diabetes. These conditions include high blood pressure, high blood sugar, excess body fat around the waist, and abnormal cholesterol or triglyceride levels. While lifestyle factors such as diet, exercise, and stress management play a significant role in the development of Metabolic Syndrome, genetic factors also contribute to an individual's susceptibility. Understanding these genetic influences can help in creating personalized strategies for prevention and management.

Genetic variations can affect key aspects of metabolism, influencing how the body processes sugars, fats, and other nutrients. For example, variations in genes related to insulin signaling, such as *TCF7L2*, can impact blood sugar regulation, increasing the risk of insulin resistance and type 2 diabetes. Other genetic factors can influence lipid metabolism, leading to abnormal cholesterol and triglyceride levels. Additionally, genes involved in regulating blood pressure and body fat distribution, such as *FTO* and *MC4R*, can contribute to the risk of developing Metabolic Syndrome. By analyzing these genetic markers, it is possible to identify individuals who are at higher risk and tailor preventive measures accordingly.

Understanding genetic predispositions to Metabolic Syndrome can inform personalized health strategies. For individuals with a higher genetic risk, early intervention is crucial. Recommendations may include adopting a heart-healthy diet rich in fruits, vegetables, whole grains, and healthy fats, alongside regular physical activity to maintain a healthy weight and improve insulin sensitivity. Stress management and adequate sleep are also important, as these factors can influence blood pressure and metabolic health. Regular monitoring of blood sugar, blood pressure, and lipid levels can help detect early signs of Metabolic Syndrome and guide adjustments to lifestyle and treatment plans. By leveraging genetic information, healthcare providers can develop comprehensive and personalized strategies to prevent and manage Metabolic Syndrome, promoting long-term health and reducing the risk of associated complications.



Metabolic Syndrome Propensity



Neutral

Understanding what this may mean

Neutral risk for developing metabolic syndrome. This indicates an average likelihood of experiencing conditions associated with metabolic syndrome. Adopting a balanced lifestyle with regular physical activity, proper nutrition, and stress management can help support metabolic health and reduce the risk of developing metabolic syndrome.

Genetic Summary ¹⁵

SNP	Marker	Genotype
MC4R (T>C)	rs17782313	TC
FTO T46-23525A	rs9939609	TT
APOA5 G*158A	rs662799	AA
APOA1 C-113T	rs670	CC
LEPR C-21+3281T	rs3790433	CC
TCF7L2 C450+33966T	rs7903146	CC
ADIPOQ G-9+3481A	rs822396	AG

SNP	Marker	Genotype
DIO2 T274C	rs225014	TC
APOA5 C553A	rs2075291	CC
TCF7L2 G552+9017T	rs12255372	GG
LEP g.G2453A	rs7799039	GG
TNF G-308A	rs1800629	GG
IL6/IL6-AS1 (G>C)	rs1800795	CC
ApoC3 C*40G	rs5128	CC

PPARG C34G

rs1801282

CG