



AUTONOMIC COACHING

**COMPREHENSIVE BLOOD CHEMISTRY PANEL
MARKERS**

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HAEMOGLOBIN

Hemoglobin is the oxygen carrying molecule in red blood cells. Measuring hemoglobin is useful to determine the cause and type of anemia and for evaluating the efficacy of anemia treatment. Hemoglobin levels may be increased in cases of dehydration.

HCT

The hematocrit (HCT) measures the percentage of the volume of red blood cells in a known volume of centrifuged blood. It is an integral part of the Complete Blood Count (CBC) or Hematology panel. Low levels of hematocrit are associated with an anemia. The hematocrit should be evaluated with the other elements on a CBC/Hematology panel to determine the cause and type of anemia.

RBC

The RBC Count determines the total number of red blood cells or erythrocytes found in a cubic millimeter of blood. The red blood cell functions to carry oxygen from the lungs to the body tissues and to transfer carbon dioxide from the tissues to the lungs where it is expelled. Increased levels are associated with dehydration, stress, a need for vitamin C and respiratory distress such as asthma. Decreased levels are primarily associated with anemia.

MCV

The MCV is a measurement of the volume in cubic microns of an average single red blood cell. MCV indicates whether the red blood cell size appears normal (normocytic), small (microcytic), or large (macrocytic). An increase or decrease in MCV can help determine the type of anemia present. An increased MCV is associated with B12, folate, or vitamin C deficiency. A decreased MCV is associated with iron and B6 deficiency.

MCH

The Mean Corpuscular Hemoglobin (MCH) is a calculated value and is an expression of the average weight of hemoglobin per red blood cell. MCH, along with MCV can be helpful in determining the type of anemia present.

MCHC

The Mean Corpuscular Hemoglobin Concentration (MCHC) measures the average concentration of hemoglobin in the red blood cells. It is a calculated value. It is elevated with B12/folate deficiency and hypochlorhydria. Decreased levels are associated with a vitamin C need, vitamin B6 and iron deficiencies, and a heavy metal body burden.

RDW

The Red Cell Distribution Width (RDW) is essentially an indication of the degree of abnormal variation in the size of red blood cells (called anisocytosis). Although the RDW will increase with vitamin B12 deficiency, folic acid, and iron anemia, it is increased most frequently with vitamin B12 deficiency anemia.

PLATELET COUNT

Platelets or thrombocytes are the smallest of the formed elements in the blood. Platelets are necessary for blood clotting, vascular integrity, and vasoconstriction. They form a platelet plug, which plugs up breaks in small vessels. Increased platelets may be seen with atherosclerosis. Decreased levels are associated with oxidative stress, heavy metal body burden and infections.

MPV

MPV or Mean Platelet Volume is a calculated measurement of the relative size of platelets in the blood. The average size of platelets increases when the body is producing more platelets and as such, the MPV can help in making assessments of platelet production in the bone marrow or platelet destruction. Elevated levels of MPV are seen with platelet destruction.

WHITE CELL COUNT

The total White Blood Cell (WBC) count measures the sum of all the WBCs in the peripheral blood. White Blood Cells fight infection, defend the body through a process called phagocytosis, and produce, transport and distribute antibodies as part of the immune process. It is important to look at the WBC differential count (neutrophils, lymphocytes, etc.) to locate the source of an increased or decreased WBC count.

NEUTROPHILS

Neutrophils are the white blood cells used by the body to combat bacterial infections and are the most numerous and important white cell in the body's reaction to inflammation. Neutrophils - % tells us the % distribution of neutrophils in the total white blood cell count. Levels will be raised in bacterial infections. Decreased levels are often seen in chronic viral infections.

LYMPHOCYTES

Lymphocytes are a type of white blood cell. An increase in Lymphocytes - % is usually a sign of a viral infection but can also be a sign of increased toxicity in the body or inflammation. Decreased levels are often seen in a chronic viral infection when the body can use up a large number of lymphocytes and oxidative stress. A decreased Lymphocytes - % may also indicate the presence of a fatigued immune response, especially with a low Total WBC count.

BASOPHILS

Basophils are one of the circulating white blood cells. They constitute a small percentage of the total white blood cell count. Basophils play an important role in the inflammatory process by releasing important substances, such as heparin, to prevent clotting in the inflamed tissue. Basophils will often be increased with tissue inflammation and is often seen with cases of intestinal parasites.

EOSINOPHILS

Eosinophils are a type of White Blood Cell, which are often increased in people that are suffering from intestinal parasites or food or environmental sensitivities/allergies.

MONOCYTES

Monocytes are white blood cells that are the body's second line of defense against infection. They are phagocytic cells that are capable of movement and remove dead cells, microorganisms, and



particulate matter from circulating blood. Levels tend to rise at the recovery phase of an infection or with chronic infection.

ESR

The ESR test is based on the fact that certain blood proteins will become altered in inflammatory conditions, causing aggregation of the red blood cells and as such it is a non-specific measure for inflammation in the body. The ESR is useful for determining the level of tissue destruction, inflammation, and is an indication that a disease process is ongoing and must be investigated.

SODIUM

Sodium is an important blood electrolyte and functions to maintain osmotic pressure, acid-base balance, aids in nerve impulse transmission, as well as renal, cardiac and adrenal functions. Increased sodium is most often due dehydration (sweating, diarrhea, vomiting, polyuria, etc.) or adrenal stress. Decreased sodium levels are associated with adrenal insufficiency and edema.

POTASSIUM

Potassium is one of the main electrolytes in the body. Due to the critical functions of potassium for human metabolism and physiology, it is essential for the body to maintain optimal serum levels even though a small concentration is found outside of the cell. Potassium levels should always be viewed in relation to the other electrolytes. Potassium concentration is greatly influenced by adrenal hormones. As such, potassium levels can be a marker for adrenal dysfunction.

CHLORIDE

Chloride plays an important role in human physiology. The amount of serum chloride is carefully regulated by the kidneys. Chloride is involved in regulating acid-base balance in the body. Increased levels are associated with metabolic acidosis and decreased levels are associated with metabolic alkalosis. Chloride is an important



molecule in the production of hydrochloric acid in the stomach so decreased levels are associated with hypochlorhydria.

CO₂

Carbon Dioxide is a measure of bicarbonate in the blood. CO₂, as bicarbonate, is available for acid-base balancing. Bicarbonate neutralizes metabolic acids in the body. Elevated levels of CO₂ are associated with metabolic alkalosis and hypochlorhydria. Decreased levels are associated with metabolic acidosis.

BUN

BUN or Blood Urea Nitrogen reflects the ratio between the production and clearance of urea in the body. Urea is formed almost entirely by the liver from both protein metabolism and protein digestion. The amount of urea excreted as BUN varies with the amount of dietary protein intake. Increased BUN may be due to an increased production of urea by the liver or decreased excretion by the kidney. BUN is a test used predominantly to measure kidney function, where it will be increased. An increased BUN is also associated with dehydration and hypochlorhydria. A low BUN is associated with malabsorption and a diet low in protein.

CREATININE

Creatinine is produced primarily from the contraction of muscle and is removed by the kidneys. A disorder of the kidney and/or urinary tract will reduce the excretion of creatinine and thus raise blood serum levels. Creatinine is traditionally used with BUN to assess for impaired kidney function. Elevated levels can also indicate dysfunction in the prostate.

BILIRUBIN

The total bilirubin is composed of two forms of bilirubin: Indirect or unconjugated bilirubin, which circulates in the blood on its way to the liver and direct or conjugated bilirubin, which is the form of bilirubin made water soluble before it is excreted in the bile. An increase in total bilirubin is associated with dysfunction or blockage in the liver, gallbladder, or biliary tree, or red blood cell hemolysis. A

decrease in Total Bilirubin is associated with an increase in oxidative stress.

ALP

Alkaline phosphatase (ALP) is a group of isoenzymes that originate in the bone, liver, intestines, skin, and placenta. It has a maximal activity at a pH of 9.0-10.0, hence the term alkaline phosphatase. Decreased levels of ALP have been associated with zinc deficiency.

Elevated levels of ALP in the serum can occur with any liver dysfunction, it is especially sensitive to any type of obstruction in the biliary tract, both intra and extra-hepatic, both severe and mild. The degree of ALP elevation is in direct correlation to the severity of the obstruction. Elevated levels not of liver origin are seen in normal bone growth in children and healing fractures.

AST

AST is an enzyme present in highly metabolic tissues such as skeletal muscle, the liver, the heart, kidney, and lungs. This enzyme is at times released into the bloodstream following cell damage or destruction. AST levels will be increased when liver cells and/or heart muscle cells and/or skeletal muscle cells are damaged. The cause of the damage must be investigated. Low levels are associated with a B6 deficiency.

ALT

ALT is an enzyme present in high concentrations in the liver and to a lesser extent skeletal muscle, the heart, and kidney. ALT will be liberated into the bloodstream following cell damage or destruction. Any condition or situation that causes damage to the hepatocytes will cause leakage of ALT into the bloodstream. These include exposure to chemicals, viruses (viral hepatitis, mononucleosis, cytomegalovirus, Epstein Barr, etc.), alcoholic hepatitis. The most common non-infectious cause of an increased ALT is a condition called steatosis (fatty liver). ALT levels may be decreased in vitamin B6 deficiency and early stages of fatty liver.

LDH



LDH represents a group of enzymes that are involved in carbohydrate metabolism. Decreased levels of LDH often correspond to hypoglycemia (especially reactive hypoglycemia), pancreatic function, and glucose metabolism. Increased levels are used to evaluate the presence of tissue damage to the cell causing a rupture in the cellular cytoplasm. LDH is found in many of the tissues of the body, especially the heart, liver, kidney, skeletal muscle, brain, red blood cells, and lungs. Damage to any of these tissues will cause an elevated serum LDH level.

CK

Creatine Kinase (CPK) is a group of enzymes found in skeletal muscle, the brain, and heart muscle. Damage to one or more of these tissues will liberate CPK into the serum thus raising serum levels. Increased levels of CPK are associated with muscle damage or breakdown, damage to the heart muscle as in an acute MI, heavy exercise and brain damage or inflammation.

GGT

Gamma Glutamyl Transferase (GGT) is an enzyme that is present in highest amounts in the liver cells and to a lesser extent the kidney, prostate, and pancreas. It is also found in the epithelial cells of the biliary tract. GGT will be liberated into the bloodstream following cell damage or destruction and/or biliary obstruction. GGT is induced by alcohol and can be elevated following chronic alcohol consumption and in alcoholism. Decreased levels are associated with vitamin B6 and magnesium deficiency.

TOTAL PROTEIN

Total serum protein is composed of albumin and total globulin. Conditions that affect albumin and total globulin readings will impact the total protein value. A decreased total protein can be an indication of malnutrition, digestive dysfunction due to HCl need, or liver dysfunction. Malnutrition leads to a decreased total protein level in the serum primarily from lack of available essential amino acids. An increased total protein is most often due to dehydration.

ALBUMIN

Albumin is one of the major blood proteins. Produced primarily in the liver, Albumin plays a major role in water distribution and serves as a transport protein for hormones and various drugs. Albumin levels are affected by digestive dysfunction and a decreased albumin can be an indication of malnutrition, digestive dysfunction due to HCl need (hypochlorhydria), or liver dysfunction.

Malnutrition leads to a decreased albumin level in the serum primarily from lack of available essential amino acids. Decreased albumin can also be a strong indicator of oxidative stress and excess free radical activity. Increased albumin is a strong indicator of dehydration.

GLOBULIN

Globulins constitute the body's antibody system and the Total serum globulin is a measurement of all the individual globulin fractions in the blood. An elevated Total globulin level is associated with hypochlorhydria, liver dysfunction, immune activation, oxidative stress and inflammation. Decreased levels are associated with inflammation in the digestive system and immune insufficiency.

CALCIUM

Serum calcium levels, which are tightly regulated within a narrow range, are principally regulated by parathyroid hormone (PTH) and vitamin D. A low calcium level indicates that calcium regulation is out of balance and not necessarily that the body is deficient of calcium and needs supplementation.

PHOSPHATE

Phosphorous levels, like calcium, are regulated by parathyroid hormone (PTH). Phosphate levels are closely tied with calcium, but they are not as strictly controlled as calcium. Plasma levels may be decreased after a high carbohydrate meal or in people with a diet high in refined carbohydrates. Serum phosphorous is a general marker for digestion. Decreased phosphorous levels are associated with hypochlorhydria. Serum levels of phosphorous may be



increased with a high phosphate consumption in the diet, and with parathyroid hypofunction and renal insufficiency.

URIC ACID

Uric acid is produced as an end-product of purine, nucleic acid, and nucleoprotein metabolism. Levels can increase due to over-production by the body or decreased excretion by the kidneys. Increased uric acid levels are associated with gout, atherosclerosis, oxidative stress, arthritis, kidney dysfunction, circulatory disorders and intestinal permeability. Decreased levels are associated with detoxification issues, molybdenum deficiency, B12/folate anemia, and copper deficiency.

F BLOOD GLUCOSE

Blood glucose levels are regulated by several important hormones including insulin and glucagon. Glucose is also directly formed in the body from carbohydrate digestion and from the conversion in the liver of other sugars, such as fructose, into glucose. Increased blood glucose is associated with type 1 & 2 diabetes, metabolic syndrome, and insulin resistance. Decreased levels of blood glucose are associated with hypoglycemia.

TRIGLYCERIDES

Serum triglycerides are composed of fatty acid molecules that enter the blood stream either from the liver or from the diet. Patients that are optimally metabolizing their fats and carbohydrates tend to have a triglyceride level about one-half of the total cholesterol level. Levels will be elevated in metabolic syndrome, fatty liver, in patients with an increased risk of cardiovascular disease, hypothyroidism and adrenal dysfunction. Levels will be decreased in liver dysfunction, a diet deficient in fat, and inflammatory processes.

CHOLESTEROL

Cholesterol is a steroid found in every cell of the body and in the plasma. It is an essential component in the structure of the cell membrane where it controls membrane fluidity. It provides the structural backbone for every steroid hormone in the body, which

includes adrenal and sex hormones and vitamin D. The myelin sheaths of nerve fibers are derived from cholesterol and the bile salts that emulsify fats are composed of cholesterol. Cholesterol is made in the body by the liver and other organs, and from dietary sources. The liver, the intestines, and the skin produce between 60-80% of the body's cholesterol. The remainder comes from the diet.

An increased cholesterol is just one of many independent risk factors for cardiovascular disease. It is also associated with metabolic syndrome, hypothyroidism, biliary stasis, and fatty liver. Decreased cholesterol levels are a strong indicator of gallbladder dysfunction, oxidative stress, inflammatory process, low fat diets and an increased heavy metal burden.

HDL

HDL functions to transport cholesterol from the peripheral tissues and vessel walls to the liver for processing and metabolism into bile salts. It is known as “good cholesterol” because it is thought that this process of bringing cholesterol from the peripheral tissue to the liver is protective against atherosclerosis. Decreased HDL is considered atherogenic, increased HDL is considered protective.

LDL

LDL functions to transport cholesterol and other fatty acids from the liver to the peripheral tissues for uptake and metabolism by the cells. It is known as “bad cholesterol” because it is thought that this process of bringing cholesterol from the liver to the peripheral tissue increases the risk for atherosclerosis. An increased LDL cholesterol is just one of many independent risk factors for cardiovascular disease. It is also associated with metabolic syndrome, oxidative stress and fatty liver.

amylase

Amylase is an enzyme that converts starch into sugar. It is produced primarily in the salivary glands and pancreas. Levels will increase with inflammation of the pancreas (pancreatitis) or salivary glands. Low levels of amylase are seen with pancreatic insufficiency, a



dysfunction of the pancreas leading to a decreased output of pancreatic enzymes.

lipase

Lipase is an enzyme involved in fat digestion. It is produced primarily in the pancreas. Levels will increase with inflammation of the pancreas (pancreatitis) and gallbladder dysfunction. Low levels may be seen with pancreatic insufficiency, a dysfunction of the pancreas leading to a decreased output of pancreatic enzymes.

TSH

TSH or thyroid stimulating hormone is a hormone produced by the anterior pituitary to control the thyroid gland's production of T4, to store T4 and to release it into the bloodstream. TSH synthesis and secretion is regulated by the release of TRH (Thyroid Releasing Hormone) from the hypothalamus. TSH levels describe the body's desire for more thyroid hormone (T4 or T3), which is done in relation to the body's need for energy. A high TSH is the body's way of saying "we need more thyroid hormone". A low TSH reflects the body's low need for thyroid hormone. Optimal TSH levels, in a normally functioning pituitary, can tell us that the amount of T4 in the blood match the body's current need and/or ability to utilize the energy necessary for optimal cell function. When the pituitary is not functioning in an optimal manner, the TSH test can be quite misleading.

free T4

T-4 is the major hormone secreted by the thyroid gland. T-4 production and secretion from the thyroid gland are stimulated by the pituitary hormone TSH. Deficiencies of zinc, copper, and vitamins A, B2, B3, B6 and C will cause a decrease in production of T4 by the follicles of the thyroid gland. Free T-4 is the unbound form of T4 in the body. Only about 0.03 – 0.05% of circulating T4 is in the free form. Free T-4 will be elevated in hyperthyroidism and decreased in hypothyroidism.

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Homocysteine

Homocysteine is a molecule formed from the incomplete metabolism of the amino acid methionine. Deficiencies in Vitamins B6, B12 and folate cause methionine to be converted into homocysteine. Homocysteine increases the risk of cardiovascular disease by causing damage to the endothelial lining of the arteries, especially in the heart. Increased levels of homocysteine are associated with an increased risk of cardiovascular disease and stroke, as well as cancer, depression and inflammatory bowel disease. Decreased levels of homocysteine are associated with a decrease in the body's detoxification capacity and an increased risk of oxidative stress.

fasting insulin

insulin is the hormone released in response to rising blood glucose levels and decreases blood glucose by transporting glucose into the cells. Often people lose their ability to utilize insulin to effectively drive blood glucose into energy-producing cells. This is commonly known as “insulin resistance” and is associated with increasing

levels of insulin in the blood. Excess insulin is associated with greater risks of heart attack, stroke, metabolic syndrome and diabetes.

Hb1ac

The Hemoglobin A1C test measures the amount of glucose that combines with hemoglobin to form glycohemoglobin during the normal lifespan of a red blood cell, which is about 120 days. The amount of glycohemoglobin formed is in direct proportion to the amount of glucose present in the blood stream during the 120-day red blood cell lifespan. In the presence of high blood glucose levels (hyperglycemia) the amount of hemoglobin that is glycosylated to form glycohemoglobin increases and the hemoglobin A1C level will be high. Hemoglobin A1C is used primarily to monitor long-term blood glucose control and to help determine therapeutic options for treatment and management. Studies have shown that the closer to normal the hemoglobin A1C levels are kept, the less likely those patients are to develop the long-term complications of diabetes.

HsCRP

High Sensitivity C-Reactive Protein (Hs-CRP) is a blood marker that can help indicate the level of chronic inflammation in the body. Increased levels are associated with an increased risk of inflammation, cardiovascular disease, stroke, and diabetes.

am Cortisol

The serum cortisol test is used to identify dysfunction in the adrenal gland such as adrenal stress or adrenal deficiency or for monitoring several diseases that cause an overproduction of cortisol (eg, Cushing syndrome) or an underproduction of cortisol (eg, Addison disease).

free T3

T-3 is the most active thyroid hormone and is primarily produced from the conversion of thyroxine (T-4) in the peripheral tissue. Free T3 is the unbound form of T3 measured in the blood. Free T3 represents approximately 8 – 10% of circulating T3 in the blood.



Free T-3 levels may be elevated with hyperthyroidism and decreased with hypothyroidism.

reverse T3

Reverse T-3 is formed from the thyroid hormone T-4 (thyroxine). It is thought to be an inactive form of thyroid hormone that acts as a sort of metabolic break on the body. High stress and cortisol levels, chronic illness, inflammation, multiple vitamin deficiencies, fasting, yo-yo dieting, poor nutrition, calorie restriction, lack of exercise and increased alcohol intake can all raise reverse T-3 levels.

serum magnesium

Magnesium is important for many different enzymatic reactions, including carbohydrate metabolism, protein synthesis, nucleic acid synthesis, and muscular contraction. Magnesium is also needed for energy production and is used by the body in the blood clotting mechanism. An increased serum magnesium is associated with kidney dysfunction and thyroid hypofunction. A decreased magnesium is a common finding with muscle cramps.

vitamin B12

Vitamin B12 is an essential nutrient for DNA synthesis and red blood cell maturation, and is also necessary for myelin sheath formation and the maintenance of nerves in the body.

serum Zinc

Zinc is a trace mineral that participates in a significant number of metabolic functions and is found throughout the body's tissues and fluids. Low levels of serum zinc are associated with zinc deficiency. Elevated levels of zinc are often seen in people supplementing with zinc.

Vitamin D

This vitamin D test measures for levels of 25-OH vitamin D and is a very good way to assess vitamin D status. Vitamin D deficiency has been associated with many disorders including many forms of cancer, hypertension, cardiovascular disease, chronic inflammation,

chronic pain, mental illness including depression, diabetes and multiple sclerosis to name just a few.

Ferritin

Ferritin is the main storage form of iron in the body. Decreased levels are strongly associated with iron deficiency where it is the most sensitive test to detect iron deficiency. Increased levels are associated with iron overload, an increasing risk of cardiovascular disease, inflammation and oxidative stress.

SHBG

Sex Hormone Binding Globulin (SHBG) is a protein produced primarily in the liver and to some extent the testes, uterus, brain, and placenta. SHBG acts as a transport molecule for carrying estrogen and testosterone around the body and delivering them to receptors on the cells.

FSH

FSH or Follicle-Stimulating Hormone is a hormone produced in and secreted by the anterior pituitary. FSH plays an important role in puberty, the menstrual cycle, and fertility.

LH

LH or Luteinizing Hormone is a hormone produced in and secreted by the anterior pituitary. LH plays an important role in puberty, the menstrual cycle, and fertility. LH levels are used in fertility diagnosis for the detection of ovulation and assessment of the onset of menopause.

Free testosterone

The free testosterone test measures the testosterone that is unbound to serum proteins such as Sex Hormone Binding Globulin (SHBG) and albumin. Levels of testosterone diminish with age and obesity, especially abdominal obesity.

In women, free testosterone can help in the evaluation of polycystic ovarian syndrome, testosterone-producing tumors of the ovary, tumors of the adrenal cortices, and congenital adrenal hyperplasia.

Testosterone is the primary sex hormone for men

Total testosterone

Testosterone is the primary sex hormone for men. The total testosterone test measures both the testosterone that is bound to serum proteins and the unbound form (free testosterone)

In women, total testosterone can help in the evaluation of polycystic ovarian syndrome, testosterone-producing tumors of the ovary, tumors of the adrenal cortices, and congenital adrenal hyperplasia.

Imbalances of testosterone in postmenopausal women are associated with various forms of coronary heart disease and cardiovascular events, including myocardial infarction.

In men, total testosterone is useful for assessing gonadal, adrenal, and pituitary function.

estradiol

Estradiol is a minor hormone in men. Estradiol is synthesized from testosterone and androstenedione in men and plays a role in male sex hormone physiology. Low levels of estradiol in men affect bone density and risk of fractures if too low.

Estradiol (E2) is the most commonly measured estrogens, the others being estrone (E1) and estriol (E3). The serum estradiol level is not specific to any phase of the menstrual cycle. It is a general assessment of estradiol. Low levels of estradiol can be a risk factor for osteoporosis and bone fracture. Estradiol may improve the quality of life in menopausal women. Increased levels of estradiol in woman suggest an increased risk of breast or endometrial cancer.

progesterone

Progesterone is a steroid hormone mainly formed in the cells of the corpus luteum and during pregnancy in the placenta. Progesterone levels are used in fertility diagnosis for the detection of ovulation and assessment of the luteal phase of menstruation.

Progesterone is often considered to be a female hormone but men produce progesterone too. In the body, it's converted into testosterone and serves to oppose and balance estrogen. As men age, their progesterone levels drop, which may cause the testosterone levels to fall.

DHEA-s

DHEA is produced primarily from the adrenals and is the most abundant circulating steroid in the human body and influences more than 150 known anabolic (repair) functions throughout the body and brain. It is the precursor for the sex hormones: testosterone, progesterone, and estrogen. Decreased levels are associated with many common age-related conditions, including diseases of the nervous, cardiovascular, and immune systems such as metabolic syndrome, coronary artery disease, osteoporosis, mood disorders and sexual dysfunction. Ideally, DHEA levels should be maintained at the level of a healthy 30-year-old to maximize the anti-aging effects.

C-Peptide

C-Peptide is used as an indicator for insulin production from the pancreas. It can help assess whether a high blood glucose is due to reduced insulin output from the pancreas or due to reduced glucose uptake by the cells, a condition called insulin resistance.