

METABOLIC DISORDERS

METABOLISM

- **SUM TOTAL OF ALL THE CHEMICAL REACTIONS OCCURRING IN BODY CELLS. REACTIONS THAT TRANSFORM SUBSTANCES INTO ENERGY OR MATERIALS THE BODY CAN USE OR STORE BY MEANS OF ANABOLISM OR CATABOLISM.**
- **THE PROCESS YOUR BODY USES TO GET OR MAKE ENERGY FROM THE FOOD YOU EAT.**
- **ANABOLISM: ENERGY-REQUIRING BUILDING PHASE OF METABOLISM IN WHICH SIMPLER SUBSTANCES ARE COMBINED TO FORM MORE COMPLEX SUBSTANCES.**
- **CATABOLISM: PROCESS IN WHICH LIVING CELLS BREAK DOWN SUBSTANCES INTO SIMPLER ONES.**

METABOLISM AND FOOD

- **Food is made up of proteins, carbohydrates and fats.**
- **Chemicals in your digestive system break the food parts down into sugars and acids, your body's fuel.**
- **Your body can use this fuel right away, or it can store the energy in your body tissues, such as your liver, muscles and body fat.**

METABOLIC DISORDERS

- **A metabolic disorder occurs when abnormal chemical reactions in your body disrupt the metabolic process.**
- **When this happens, you might have too much of some substances or too little of other ones that you need to stay healthy.**
- **You can develop a metabolic disorder when some organs, such as your liver or pancreas, become diseased or do not function normally.**
- **Diabetes is an example**

INHERITED METABOLIC DISORDERS

- Metabolic disorders generally refer to a broad array of medical problems caused by inherited genetic defects that interfere with the body's metabolism.**
- Most metabolic genetic defects are passed from both parents to their biological child.**
- While there are thousands of metabolic disorders, each caused by a different genetic defect, they cumulatively affect about one in every 4,000 people.**

EXAMPLES OF GENETIC METABOLIC DISORDERS

- **A few metabolic disorders include:**
- **TAY-SACHS DISEASE**
- **LEUKODYSTROPHIES**
- **LYSOSOMAL DISORDERS**
- **WILSON'S DISEASE**

TAY-SACHS DISEASE

- **A genetically inherited disorder**
- **The child's brain and nervous system progressively deteriorate.**
- **Leads to blindness, deafness, paralysis and death.**
- **Infant begins to show symptoms around 6 months old and die within a few years.**
- **Late-onset Tay-Sachs may develop in adolescence and adulthood.**
- **Symptom -- A "cherry-red" spot in the back of the eyes.**
- **There is no cure for Tay-Sachs.**
- **Gene therapy research may eventually lead to a cure or treatment to slow the progression.**

Metachromatic Leukodystrophy (MLD)

- **MLD is a genetically inherited disorder**
- **The brain and nervous system progressively deteriorate, the patient loses brain and body functions and eventually dies.**
- **Treatment options are very limited.**
- **Bone marrow transplantation in early stages has been used effectively, but poses some risk.**
- **Gene therapy research may eventually lead to a cure, treatment to slow the progression.**
- **Genetic testing and counseling strongly recommended for adults with a family history of MLD.**

Wilson's Disease

Symptoms:

- **Liver**: Acute hepatitis to liver failure.
- **Neurological**: Movement disorders, drooling, seizures, migraines, insomnia.
- **Psychiatric**: Depression, neuroses, personality changes, psychosis.

Wilson's Disease

Other symptoms may include:

- Kidney problems; Skeletal problems; Thyroid problems**
- Heart, pancreas or gynecological problems; Recurrent or unexplained fever**
- Jaundice; Shortness of breath; Excessive tiredness; Stiff limbs**
- Difficulty swallowing; Abdominal pain; Bone pain; Hemolytic anemia; Gallstones**
- Speech problems; Abnormal movements; Deterioration of handwriting**

Wilson's Disease

Treatment Options:

- **Effective if diagnosed before the onset of life-threatening symptoms.**
- **Combination of oral medications and dietary changes needed to halt disease progress.**
- **If treatment is stopped, the disease can be fatal.**
- **In case of acute liver failure, a liver transplant may be necessary.**
- **For severe neurological dysfunctions, up-to-date management and rehabilitation therapy are provided.**

Lysosomal Storage Disorders

- **Inherited defects or deficiencies of lysosomal enzymes (or other lysosomal components) can result in accumulation of undegraded metabolites.**
- **Because there are numerous specific deficiencies, storage diseases are usually grouped biochemically by the accumulated metabolite.**

Lysosomal Storage Disorders

- **Because reticuloendothelial cells (e.g., in the spleen) are rich in lysosomes, such tissues are involved in a number of lysosomal storage disorders, but generally, tissues richest in the substrate are most affected.**
- **The brain, which is rich in gangliosides, is particularly affected by gangliosidoses, whereas mucopolysaccharidoses affect many tissues because mucopolysaccharides are present throughout the body.**

PROCESSES OF GENETIC METABOLIC DISORDERS

- The genetic defect may cause an enzyme to function abnormally or cause the body to produce too little or none of an enzyme.**
- In some cases, the defect means certain substances are not broken down and can build to toxic levels.**
- In other cases, the body is not able to provide a critical substance to body cells.**
- Metabolic disorders are classified into types based on the components of the cell involved, biochemical pathways and which enzyme is affected.**

What Is Diabetes?

- **The term *diabetes mellitus* is a metabolic disorder derived from the Greek words meaning “to run through.”**
- **The cells of a diabetic patient can’t absorb the needed nourishment.**
- **The nutrients literally run through the body instead of feeding it.**

TYPES OF DIABETES

Three Types:

- **Type 1**
- **Type 2**
- **Gestational diabetes**

TYPE 1 DIABETES

- **Type 1 is characterized by a defect in the islet cells of the pancreas that makes them unable to produce any insulin at all.**
- **Previously referred to as *juvenile diabetes*.**
- **Type 1 is thought to be autoimmune in nature and is generally diagnosed in early childhood.**

TYPE 2 DIABETES

- **Type 2, develops when cells become resistant to insulin.**
- **Also commonly referred to as *adult onset diabetes mellitus* or noninsulin-dependent diabetes.**

TYPE 2 DIABETES

- **It develops gradually over time.**
- **Several risk factors can increase your likelihood of developing it.**
- **The progression toward type 2 diabetes begins when you become resistant to your own insulin.**
- **In functional medicine, insulin resistance is an early indication of metabolic syndrome.**

GESTATIONAL DIABETES

Gestational diabetes occurs late in pregnancy when a mother's hormones interfere with her ability to utilize insulin.

METABOLIC SYNDROME

- **In functional medicine, insulin resistance and metabolic syndrome are the same thing.**
- **We view them this way because they begin with the same faulty cell signaling.**
- **Causes metabolic disorders and damage.**
- **Eventually causes degenerative diseases.**
- **Same symptoms used in the conventional diagnosis of metabolic syndrome.**

METABOLIC SYNDROME

- **The diagnosis of metabolic syndrome is made when three or more of five disorders are present in the patient:**
- **High triglycerides, low HDL cholesterol, high blood sugar, high blood pressure and an above-average waistline.**

Causes Of Prediabetes And Diabetes Progression

- Type 2 diabetes manifests itself differently in each individual.**
- Symptoms and severity may vary.**
- Starting point for most women is a diet with a high glycemic load (high in refined sugars and carbohydrates), combined with inactivity and a family history of type 2 diabetes.**

Causes Of Prediabetes And Diabetes Progression

- Next, the body reacts to high blood sugar by producing more insulin.**
- With persistently high insulin levels, cells eventually build up a resistance to it and stop opening their doors.**
- This stage, known as insulin resistance, is when glucose begins to pass through the body without being absorbed.**

Diabetes Progression

- Soon the pancreas gets the message and decreases insulin production.**
- As insulin levels drop and diet remains high in glucose, blood sugar continues to creep up.**
- Ultimately, insulin levels drop and blood sugar jumps dramatically.**
- This is the point where the official diagnosis of diabetes is typically made.**

Diabetes Progression

- The harmful effects of insulin resistance cut across all the body's systems.**
- The severity at this point varies widely from individual to individual based on the health of their other systems.**
- Some people with diabetes continue to make small amounts of insulin and can control their blood sugar through diet.**
- Others stop producing insulin and have to rely on outside sources of insulin.**

DIAGNOSIS

- **Standard blood tests look at blood sugar, among other things**
- **Insulin levels are among the first markers of change on the pathway to diabetes.**
- **Numbers may differ from lab to lab, but type 2 diabetes is generally diagnosed when fasting blood glucose has reached 126 mg/dL or higher (compared to a normal range blood sugar level between 70 and 99 mg/dL).**

DIABETES PREVENTION AND TREATMENT

Fact: Many of us are walking around with prediabetes

All forms of diabetes, if left untreated, can lead to serious complications, including:

- **Eye problems**
- **Compromised circulation**
- **Kidney damage**
- **Nerve damage**

DIABETES PREVENTION AND TREATMENT

- **Staying on top of insulin early can help you avoid type 2 diabetes --- insulin imbalance**
- **And also help to avoid the problems associated with it, including imbalance of your sex hormones.**

DIABETES PREVENTION AND TREATMENT

- **Many people (especially women) don't realize that nutrition is integrally connected to the web of hormonal balance.**
- **If you change your diet, you can change your hormones.**
- **By eating balanced meals, including complex carbohydrates and high quality protein and fats, you can regulate the insulin your body releases and keep estrogen and testosterone in balance.**

DIABETES CONTROL

- **The pillars of diabetes control are:**
- *Nutrition*
- *Exercise*
- *Blood glucose regulation*
- *Emotional wellbeing*

DIABETES CONTROL

Nutrition

Have Balanced Meals.

This means that each time you eat, you should include:

Protein,

Complex carbohydrates,

Healthy fats, and

As many non-starchy fruits and vegetables as you can.

DIABETES CONTROL

Exercise

- **Keeps your weight down.**
- **Lowers blood sugar.**
- **Helps you utilize insulin more efficiently.**
- **Keeps your cholesterol levels balanced.**
- **Improves circulation, thereby keeping your heart and blood vessels healthy and strong.**
- **Supports nervous system health and releases positive endorphins to boost your mood.**

DIABETES CONTROL

Regulation of Blood Glucose & Emotional Stability

- **Through diet and lifestyle.**
- **Eat well; have good exercise.**
- **Once you go above 100 mg/dL, you are considered prediabetic.**
- **65% of diabetes patients die from heart disease or stroke, which tells us that treatment should be about more than just glucose control.**
- **Emotions – thoughts and deeds that make you relaxed and happy.**

DIABETES CONTROL

Insulin Control

- **Strongly affected by the *glycemic index* of the foods you eat.**
- **The glycemic index of a food is a measure for how quickly insulin rises in response to the amount of glucose entering your blood stream after you eat it.**

DIABETES CONTROL

Insulin Control

- **Foods high in protein tend to have a lower glycemic index than carbohydrates.**
- **Simple carbs, like white flour and sugar, have a higher glycemic index than complex carbs like whole grains and fresh fruits.**
- **Simple carbs can overload your insulin receptors and make insulin resistance more likely to develop.**
- **To prevent the quick sugar surge from high glycemic foods, balance each snack and meal with all four basic groups.**

DIABETES CONTROL

- **Micronutrients in fresh, richly colored, organically grown fruits and vegetables help to prevent the diseases of modern life — including type 2 diabetes.**
- **Choose the best information your food dollar can buy, and remember that all four food groups play key roles in your digestion, metabolism and hormonal balance.**

DIABETES TEST

The A1C Test

- **Reflects your average blood glucose level over the last 3 months. It is the best way to know your overall blood glucose control during this period of time. This test used to be called hemoglobin A-1-C or H-b-A-1-C.**
- **The Blood Glucose Self Test :**
Uses a drop of blood and a meter that measures the level of glucose in your blood at the time you do the test. This is called self-monitoring of blood glucose (SMBG).

DIABETES TEST

- **For most people with diabetes, the A1C goal is less than 7.**
- **An A1C higher than 7 means that you have a greater chance of eye disease, kidney disease, or nerve damage.**
- **Lowering your A1C—by any amount— can improve your chances of staying healthy.**

DIABETES TEST

Pregnancy And A1C Goals

- Keeping your A1C less than 6 if you are pregnant will help ensure a healthy baby.**
- If possible, women should plan ahead and work to get their A1C below 6 before getting pregnant.**

BMI

- **BMI is a formula that factors in height and weight to produce a number designed to estimate the presence of excess body fat.**
- **Compared to going by body weight alone, a BMI measurement is a better assessment of fatness since it takes height into account.**

BMI And Health Risks

Higher BMI numbers are associated with increased risks of disease and death, from conditions such as cardiovascular disease, type 2 diabetes and some cancers.

BMI And Health Risks

- **Research has found that the lowest and highest BMIs are associated with highest risks.**
- **BMI numbers are grouped into categories meant to reflect the degree of risk a person faces.**
- **People with the lowest risks of disease seem to fall in the 18.5 to 24.9 BMI range, so they are considered to be “normal.”**

BMI And Health Risks

- **A BMI of 25 seems to be the threshold where disease risk significantly increases.**
- **A BMI of 30 confers even greater health risks.**
- **These ranges have therefore been separated into “overweight” and “obese” categories.**

BMI And Health Risks

- Extremely high BMIs are linked to even greater risks of certain diseases.**
- An “underweight” category is included because being overly thin is also associated with increased health risks.**
- For example, people in the underweight category may have anorexia nervosa, cancer (associated with weight loss), or be smokers (who tend to be thinner.)**

CLASSIFICATION OF OVERWEIGHT AND OBESITY BY BMI

<u>Classification</u> (kg/m ²)	<u>Obesity Class</u>	<u>BMI</u>
• Underweight		<18.5
• Normal		18.5-24.9
• Overweight		25.0-29.9
• Obesity	I	30.0-34.9
•	II	35.0-39.9
• Extreme Obesity	III	40+

**COPYRIGHT JANUARY 2009
DR. SAMUEL KISSEADOO
BIOLOGICAL SCIENCES DEPARTMENT
HAMPTON UNIVERSITY
HAMPTON, VIRGINIA 23668, USA
samuel.kisseadoo@hamptonu.edu**