

THE METABOLIC SYNDROME

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What is the metabolic syndrome? The metabolic syndrome is a cluster of conditions that occur together and can increase your risk of developing heart disease and type 2 diabetes. To have the metabolic syndrome (which is sometimes also called insulin resistance syndrome), you need to be diagnosed with three or more of the following conditions:

- increased blood pressure
- high blood sugar (which is your blood glucose levels)
- excess body fat, especially around the waist
- an abnormal amount of fat (cholesterol or triglyceride) in your blood
- an increased risk of developing blood clots
- a tendency to develop inflammation (irritation and sometimes swelling of body tissue)

Having the metabolic syndrome increases an individual's risk of developing heart disease and/or diabetes. Although it is a serious condition, you can reduce your risk of developing it and other diseases associated with it by reducing body weight, increasing physical activity levels and consuming a diet rich in fruit, vegetables, whole-grains, fish and lean meats.

Explain the role of obesity in causing the metabolic syndrome: When excess nutrients are consumed, they are stored in fat tissue (also known as adipose tissue) until they are required for energy at a later time. Fat tissue is found throughout a person's body and can increase in size to store excess nutrients. In some people who develop a lot of fat tissue (known as obesity) the tissue no longer functions properly. The adipose tissue cells become less effective at taking up and storing nutrients like fats and sugars. When this happens, the adipose tissue no longer functions well and other organs, such as the liver and muscles, may be exposed to more nutrients than usual, which may alter how they function. For example, the liver may start to produce more fat and sugar, leading to higher levels than normal in the bloodstream. This increases the risk of someone developing the metabolic syndrome.

What is diabetes? Diabetes is a condition that causes a person's blood sugar levels to become too high. There are two main types of diabetes:

- Type 1 diabetes – this develops when the body's immune system attacks and destroys the cells that produce a hormone called insulin, which is needed to help control blood sugar (glucose) levels. It is usually first diagnosed in childhood and is a lifelong condition, with patients being required to inject insulin to make up for their body not being able to produce it itself.
- Type 2 diabetes – this is when the body does not produce enough insulin or when cells do not react to insulin as they should. Excess body weight increases the risk of developing type 2 diabetes and it is usually diagnosed in adults.

Type 2 diabetes is the most common form of diabetes in the UK: around 90% of all adults with diabetes have type 2. How much sugar is in the blood is controlled by the hormone insulin which is produced by the pancreas (a gland behind the stomach). After eating a meal, carbohydrates (e.g. starches in bread, pasta, vegetables and sugars in foods) are digested and broken down into glucose. This glucose enters the bloodstream and travels to organs around the body, where it can then be either stored or broken down to produce energy. Insulin is responsible for moving the glucose out of the blood into cells (in a complex series of reactions). For people with type 2 diabetes, their body is not so efficient at moving the glucose out of the bloodstream. This is because there is either not enough insulin being released from the pancreas or the insulin produced does not work properly. In this case, the pancreas will produce more insulin to try and overcome the problem but eventually it may become dysfunctional, no longer able to produce enough of the hormone.

Type 2 diabetes causes sugars to build up in the blood and increases risks of kidney failure and cardiovascular disease. The condition can be managed through healthy eating, regular exercise and achieving a healthy body weight. Some people with type 2 diabetes take medication to help control their blood glucose levels. In individuals with a lot of body fat, it has recently been shown that losing over 10% of body weight by consuming a very low calorie diet may help to become free of diabetes.

What is heart disease? Heart disease and heart attacks occur when there has been too much fat (cholesterol and triglyceride) in the blood over a long period of time. This fat ends up deposited in the walls of blood vessels (arteries). Over time the arteries that supply blood to the heart become narrowed or blocked by these fatty deposits (called plaques), decreasing the amount of blood and oxygen reaching the heart. This can cause chest pain (angina) or a heart attack.

What is non-alcoholic fatty liver disease? In a healthy body, the liver can be considered a lean, mean, metabolic machine. However, if it starts to become filled with fat, it is called a fatty liver. Although this can occur in someone who drinks too much alcohol, the problem can affect people whose alcohol consumption is within the recommended guidelines. In this case, the condition is called non-alcoholic fatty liver disease (or NAFLD). NAFLD is an umbrella term for a range of liver conditions, from fatty liver to liver failure. Why fat starts to build up in the liver isn't clear, but both the amount and type of food eaten may play an important role. NAFLD is closely linked with obesity and also with the metabolic syndrome. Individuals with NAFLD have a higher risk of developing type 2 diabetes and heart disease than individuals without NAFLD.

Explain the difference between glucose and fructose: Glucose and fructose are two simple sugars present in foods, either on their own or bound together as sucrose. Glucose and fructose share the same basic chemical building blocks but these building blocks are assembled in different positions. So the overall structure of glucose and fructose differs and because of this, the way that they enter cells and how they are used (or metabolised) within those cells also differs. It is thought that only liver cells can metabolise fructose, while all organs within the body (e.g. fat tissue, muscle, heart, brain), as well as the liver, can metabolise glucose. Glucose, unlike fructose, also stimulates the release of the hormone insulin which helps in clearing any excess glucose from the blood. We always have some glucose in our blood, even when we are fasting: the liver is able to release glucose it has stored (as glycogen) and it can also make glucose from scratch using other molecular compounds present in the body (like amino acids). In contrast, fructose is not produced within the body and the only time cells are exposed to it is when we consume food or drinks containing it (like fruit, sweets, etc). Both fructose and glucose can be stored as glycogen and used to make new fats or to make energy. Fructose is much sweeter than glucose and it is often added alongside glucose to confectionary, sugar-sweetened beverages and some breakfast cereals. When sugars are added to foods, they are known as 'free' sugars, because they are not naturally occurring, such as in fresh fruits.

Is fructose more of a "villain" than glucose? Over the last few years fructose has been seen as a "villain". Studies have suggested that the overconsumption of fructose, when added to processed foods and drinks, results in obesity and increased levels of liver and blood fat. In fact, we rarely consume fructose in isolation but often together with glucose (in the form of free sugars). However, it has been suggested that the fructose component of these free sugars is what causes the liver to make and store more fat. We do know that consuming excess sugars can be bad for our health. It is also relatively easy to consume excess sugars, for example sweetened soft drinks don't make us feel as full as eating the same amount of sugar in a fruit. Is the problem due to consuming too many calories or is it due to a specific effect of excess fructose? At the moment the scientific evidence isn't complete and we can't come to a definite conclusion: the jury is still out as to whether fructose is a worse villain than glucose or other baddies like saturated fat!

What is the most important way to improve our health (in the context of the metabolic syndrome): to eat less refined sugar, or less carbohydrates, or less calories? Or all of them? To improve our health and lower the risk of developing the metabolic syndrome, we need to eat a diet that contains plenty of fruits, vegetables and whole-grain foods (such as beans and pulses), alongside lean meats and some dairy products. These foods will provide a range of vitamins, minerals and fibre which are important for our health. It is also advised to lower the consumption of foods containing 'added' sugars. If you eat or drink a lot of added/free sugars (e.g. in sugar-sweetened beverages and candy products), this can result in your blood sugar levels fluctuating a lot over the course of the day: you will feel very 'energised' for a little while but then very 'tired' not long after. By consuming less added/free sugars and more food rich in fibre such as vegetables and whole-grain products, this will help keep your blood sugar levels more 'stable'. If you want to decrease your body weight, then eating less calories is also good, particularly if you are at risk of the metabolic syndrome.