The breakdown of fructose

First of all I would like to describe the term enzymes. Basically enzymes are protein which is used in the chemical reaction and they act as a catalyst in these reactions. Their function is to speed up the chemical reaction without using themselves. If they are not used as a catalyst in the reactions than the reaction speed would be very slow and in this way the products of the reactions will not come. So it is now clear that enzymes are very important in certain biochemical reactions which are taking place in our body and without these enzymes our body will not be able to perform these biochemical reactions and as a result we will not be able to continue our life.

Enzymes are involved in the breakdown of fructose. Basically fructose is simple sugar that is present in our food like honey and fruits. Fructose is basically a carbohydrate which provides energy to our body. it is very important to mention that fructose do not gave energy to our body directly but certain enzymes are require to breakdown this fructose into simpler sugar and then into usable form of energy.

The process of the breakdown of fructose is as follows:

Firstly when fructose in enters in our body then initial catabolism of fructose is takes place in our body and this process is referred to as fructolysis. The cycle of fructose breakdown begins with the enzyme called fructokinase which is found in liver. This fructokinase will produce fructose 1- phosphate so this is the end of first step.

In the next step another enzyme named aldolase B will convert the fructose 1-phosphate into dihydroxyacetone phosphate (DHAP) and glyceraldehyde. These two products are used by the body in order to get energy so without

these enzymes the body will not be able to carry out the breakdown of fructose and in this way our body will not be able to ingest the food containing fructose. (Seller et al., 1969)

Explain how a deficiency in aldolase B can be responsible for hereditary fructose intolerance.

First of all I would like to explain the term fructose intolerance. Fructose intolerance is basically a condition in which the person is not able to digest the sugar fructose. After taking fructose containing diet like honey or fruits the person with fructose intolerance may experience nausea, bloating, abdominal pain, diarrhea and vomiting etc.

Basically mutation in Adolab gene leads to the hereditary fructose intolerance. This Aldolab is responsible for the formation of Aldolase B enzyme. As I already mention that this enzyme is present in Liver and causes the breakdown of fructose and thus convert this fructose into simpler sugar which is then used as a source of energy in our body.

A deficiency in the enzyme Aldolase B may cause the accumulation of the fructose 1-phosphate in the liver cell, small intestine and kidney and thus make our body unable to convert the fructose into simpler sugars and as a result the sugar level of the body will fall and cause the formation of the toxic substance that damage our liver. This damage to the liver cell leads to the liver dysfunctions, hypoglycemia and hereditary fructose intolerance. (Gitzelmann et al., 1989)

Explain the role of aldolase B in the breakdown of fructose.

Aldolase B plays an important role in the carbohydrate metabolism like it catalyzes one of the major steps of the glycolytic-gluconeogenic pathway. Along with its importance in the glucose breakdown it is also very important in fructose metabolism and it is very important to mention that fructose metabolism is occurring mostly in the liver, renal cortex and small intestine. The action of mechanism of this enzyme is that when fructose is absorbed by our body it is than phosphorylated into fructose 1-phospahte by the action of fructokinase. Then in the next step Aldolase B catalyzes the fructose 1-phosphate and converts it into glyceraldehyde and DHAP.

After this step another enzyme triose kinase convert this glyceraldehyde into glyceraldehyde 3-phosphate which is then used in glycolytic-gluconeogenic pathway and that can be modified to become either glucose or pyruvate. (Peanasky et al., 1958)

Discuss the specific substrate acted on by aldolase B.

Aldolase B is equally active toward the substrate F-l-P (Fructose-1-Phosphate). Fructose-1-phosphate is a derivative of fructose. It is generated by fructokinase which is present in liver. It is converted by aldolase B into glyceraldehyde and dihydroxyacetone phosphate.

The action of the adolase B on the substrate can be explained with the help of following figure:

A description...

CASE 2- MITOCHONDRIAL DISEASE

Explain what would happen to the cell's energy reserves if the interconversions of the Cori cycle occurred and remained within a single cell.

If interconversion of the coricycle occurred within the single cell then it would cause the futile cycle. Basically in the futile cycle glucose is used by the cell and re synthesized at the cost of ATP and GTP hydrolysis. And loss of ATP during this futile cycle would be 4 and that's why the futile cycle is regarded as an uneconomical cycle. (Nelson et al., 2005).

Construct a dynamic model to show the doctor why the citric acid cycle is central to aerobic metabolism.

The citric acid cycle can be regarded as an important metabolic center of the cell. It basically act as portal to the aerobic metabolism that has the ability to form acetyl group or dicarboxylic acid. The citric acid cycle is not only act as fuel for the cell but it is also a building block of many other molecules like amino acid, cholesterol, and porphyrin (the organic component of heme).

There are infact different reactions like oxidation and reduction reactions which are takes place during Krebs cycle, and these reactions will result in the oxidation of an acetyl group to two molecules of carbon dioxide.

The Kreb cycle was named after the person who introduce this cycle for the first time. Different biochemical changes are noticed during Krebs cycle which will enable the cell to store the energy for future use. The other name for this Kreb cycle is tricarboxylic or citric acid, cycle. ((Lowenstein JM 1969).

Explain the role of co-enzyme Q10 in ATP synthesis.

First of all I would like to give a brief introduction of Co-enzyme Q10. Co-enzyme Q10 is basically a vitamin like substance which is present in every cell and its purpose is to generate energy. And due to this property it is also called as Ubiquitous. It is necessary in energy production in the 70-100 trillion body cells.

Basically the co-enzyme Q10 is required in order to convert the energy from carbohydrate and fats into Adenosine triphosphate (ATP), and this process of production of ATP is carryout in the inner mitochondrial membrane. The process is like first of all the electrons which are produced during the fatty acid and glucose metabolism, Co-enzyme Q10 accept these electrons and then converted them into electron acceptors. At the same time Co-enzyme Q10 transfer the proton outside the mitochondrial membrane and in this way cause the formation of a proton gradient across that membrane. The energy released when the protons flow back into the mitochondrial interior and in this way it is used to form ATP. (Tomono et al., 1986)

Explain where in the citric acid cycle a hypothetical defect could occur that prevents an increased conversion of adenosine diphosphate (ADP) to adenosine triphosphate (ATP) in response to an increased energy need and how the products of the citric acid cycle are converted into ATP.

Basically during the Krebs cycle, a small amount of energy is released in order to cause the formation of molecule of ATP. It is very important to mention that in fact four-carbon molecule(oxaloacetic acid) is again created after the formation of CO2 mainly through oxidation reactions that occur in the Electron Transport Chain therefore any defect in ETC will prevent the conversion of ADP to ATP. Basically a gradient is formed in the ETC which is

used to produce the ATP and this ATP is generated when H+ ion move down to its concentration gradient by a special enzyme called ATP synthase… so it is now clear to us that if there is any defect in Electron transport chain then this will prevent the conversion of ADP to ATP.

The products of Citric acid cycle are converted into ATP with the help of Oxidative- phosphorylation which is taking place in mitochondria. The NADH and succinate which is the product of Krebs cycle are oxidized and this will release the energy. This energy will power the ATP synthase and this enzyme will facilitate the production of ATP. (Mitchell and Moyle 1967).