The fate of fructose in the body

Fate of fructose in the liver

On the one hand, fructose is very quickly absorbed by the liver, where it is also metabolized using the enzyme "fructokinase" specific for fructose phosphorylation. Now let's look at the corresponding reaction:

Fructose + ATP → fructose-1-P + ADP

catalyzed by fructokinase

Fructose-1-P is not an intermediate product of glycolysis and its further transformation is catalyzed by the so-called *aldolase B* (different from aldolase A in glycolysis).
The cleavage of Fructose-1-P produces two trioses – glyceraldehyde and dihydroxyacetone phosphate.

- '*Dihydroxyacetone phosphate* can be immediately involved as an intermediate of glycolysis.
- '*Glyceraldehyde* has a more complicated fate. It can be phosphorylated by a specific kinase to *glyceraldehyde-3-phosphate*, or it can be reduced to *glycerol*.

  Phosphorylation is much more important, as it serves to connect glyceraldehyde to glycolysis.

Fructose-1-P' → dihydroxyacetone phosphate' + D-glyceraldehyde

catalyzed by specific aldolase B

Dihydroxyacetone phosphate' → glyceraldehyde-3-P' → glycolysis

D-glyceraldehyde' → glyceraldehyde-3-P' → glycolysis

or → **glycerol → glycerol-3-phosphate' → triacylglycerols**

There is a very rare congenital defect of aldolase B that causes a disease called fructose intolerance, in which Fru-1-P accumulates, resulting in an imbalance in carbohydrate metabolism.

Fructose metabolism is **faster'** than glucose metabolism, as the main regulatory (slowest) step of glycolysis catalyzed by *phosphofructokinase* is bypassed.
As a result, this can lead to increased hepatic lipogenesis – from the excess pyruvate (and subsequently AcCoA) produced, an excessive amount of fatty acids and triacylglycerols are produced.

Alternative fate of fructose

To a lesser extent and also in other tissues (e.g. muscles) fructose is phosphorylated by *hexokinase*:

Fructose' + ATP' → Fructose-6-P' + ADP

The resulting Fructose-6-P is a direct intermediate product of glycolysis, and the route of connecting fructose therefore takes much less time.
However, hexokinase has a higher K_m for fructose and thus a low affinity.