

ADIPOSE TISSUE METABOLISM

Triacylglycerol is the major storage form of lipid in humans. Adipose tissue is the main store of triacylglycerol in the body. The triacylglycerol stored in adipose tissue is continually undergoing **lipolysis** (hydrolysis) and **resynthesis**.

Synthesis of Triacylglycerol in Adipose Tissue

- In adipose tissue triacylglycerol is synthesized from acyl-CoA and glycerol-3-phosphate.
- For provision of glycerol-3-phosphate, the tissue is dependent on glycolysis and a supply of glucose. The transport of glucose into adipose tissue is stimulated by insulin.
- Some fatty acids, that are incorporated into the triacylglycerol, are synthesized within the adipose tissue from glucose. The remainder is taken up from the blood, which is formed by the action of lipo-

protein lipase on the triacylglycerol of chylomicrons and VLDL. Insulin stimulates this process by stimulating lipoprotein lipase.

Figure 13.31 summarises the process of triacylglycerol synthesis in adipose tissue.

Degradation of Triacylglycerols in Adipose Tissue

To leave the adipose tissue, the triacylglycerol must be hydrolyzed to fatty acids and glycerol.

- Triacylglycerol undergoes hydrolysis by a *hormone sensitive lipase* to form free fatty acids and glycerol.
- This lipase is distinct from lipoprotein lipase, that catalyzes hydrolysis of triacylglycerol before its uptake into extrahepatic tissues.
- The glycerol produced by lipolysis cannot be used by adipose tissues because they lack the enzyme *glycerol kinase*.

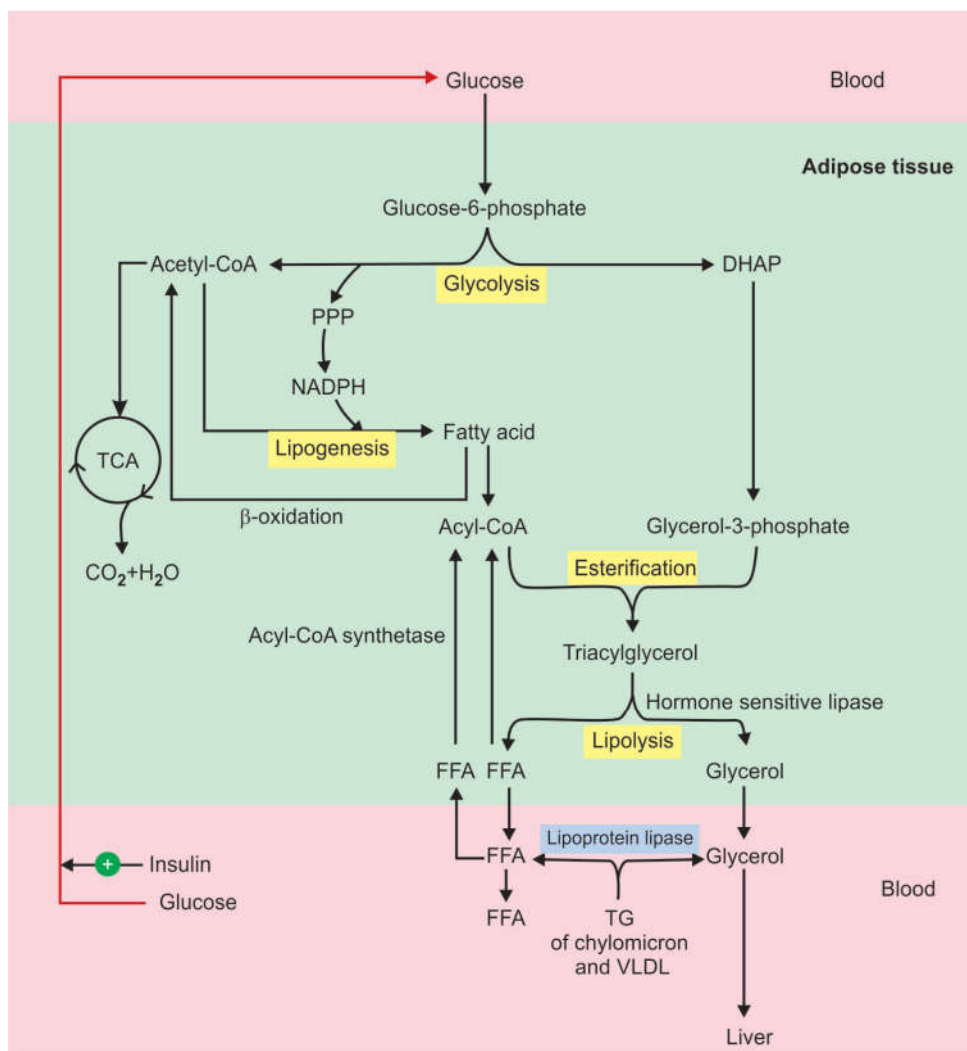


Figure 13.31: Adipose tissue metabolism where, PPP: Pentose-phosphate pathway; TG: Triacylglycerol; FFA: Free fatty acid; DHAP: Dihydroxy acetone phosphate

- Therefore, the glycerol is transported to the liver which contains, *glycerol kinase* to metabolize glycerol to glucose by the process of gluconeogenesis.
- The free fatty acid formed by lipolysis can be reconverted in the adipose tissue to acyl-CoA by *acyl-CoA synthetase* and re-esterified with glycerol-3-phosphate to form triacylglycerol.

Thus, there is a continuous cycle of lipolysis and resynthesis (re-esterification) within the adipose tissue. However, when the rate of re-esterification is not sufficient to match the rate of lipolysis, free fatty acids accumulate and diffuse into the plasma and raise the concentration of plasma free fatty acids, which occurs during fasting, diabetes mellitus, anxiety or physical exertion.

Significance of Adipose Tissue Metabolism

Fat is stored in the adipose tissue when food is plentiful and the individual is calm and resting. Conversely, fat is made available from adipose tissue in postabsorptive state or in stressful situations like starvation and diabetes mellitus.

Regulation of Adipose Tissue Metabolism (Figure 13.32)

- High levels of insulin in the blood stimulate triacylglycerol formation in adipose tissue and inhibits the lipolysis by inhibiting hormone sensitive lipase.
- Conversely, low insulin concentrations enhance the mobilization of fatty acid from adipose tissue
- Other hormones like epinephrine and glucagon accelerate the rate of lipolysis of triacylglycerol stores. These hormones activate hormone sensitive lipase.

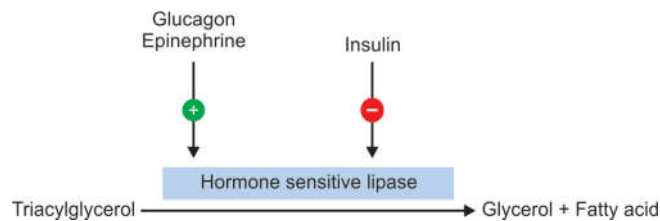


Figure 13.32 Regulation of lipolysis in adipose tissue