

# Triglycerides

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# Intended learning outcomes

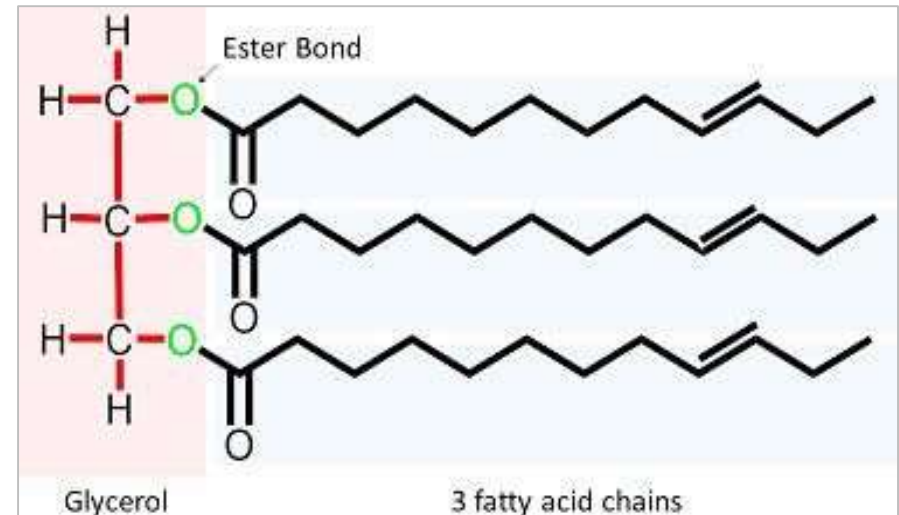


Identify the principles of the triglycerides test

Calculation of TG concentration in the unknown sample

# Triglycerides

- An ester of **glycerol** with three **fatty acids**
- Also known as triacylglycerols
- One type of lipid categorized as simple lipid

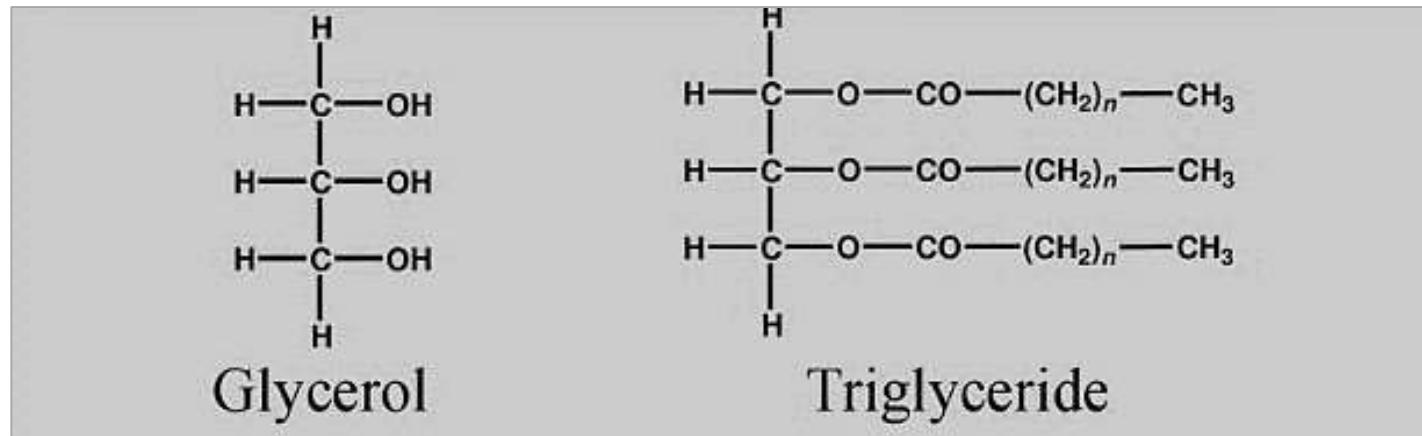


# Triglycerides

- Each fatty acid (FA) can be different
- Triglycerides with saturated FA (no kinks)

**pack tightly → solid at room temperature**

- Triglycerides with unsaturated FA typically oils at room temp



# Triglycerides

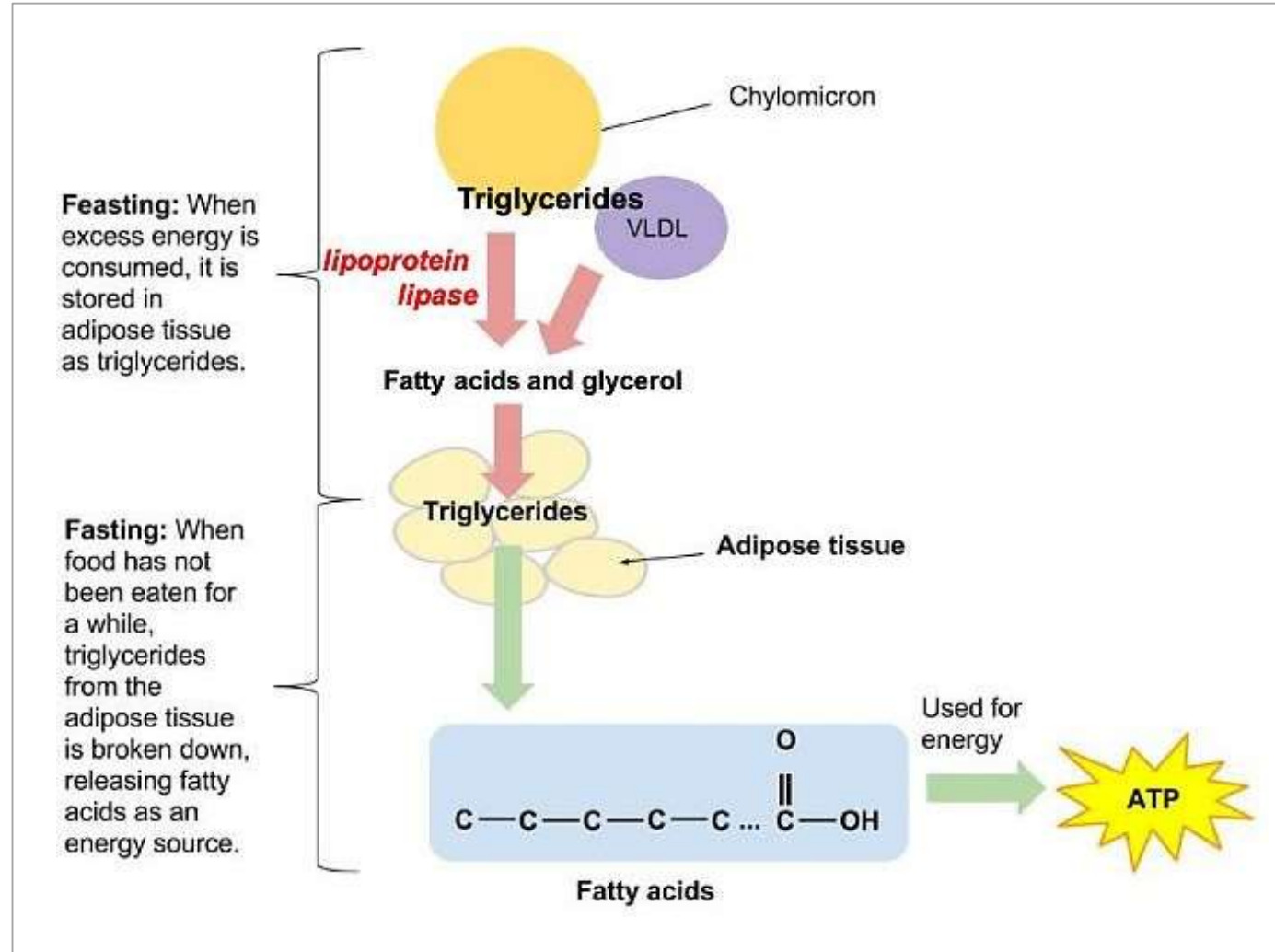
- Triglycerides (TG) represent a concentrated source of metabolic energy and they are a mechanism for **storing energy**
- TG are transported as core constituents of all lipoproteins, but the greatest concentration is in TG-rich **chylomicrons** and **VLDL** particles
- Some TG are needed for good health but high triglycerides can raise the risk of heart disease and may be sign of metabolic syndrome

# Formation of Triglycerides

- **Fat and liver cells** cooperate to **synthesize** and store triglycerides
- The high concentration of triglycerides in the blood correlates with the consumption of starchy and fatty food
- Triglycerides cannot pass through cell membranes freely. Special enzymes on the walls of blood vessels (**lipoprotein lipases**) must break down triglycerides into free **fatty acids** and **glycerol**.

# Formation of Triglycerides

When the body requires **fatty acids as an energy source** (in case of absence of carbohydrate), the hormone glucagon signals the breakdown of triglycerides by **hormonal-sensitive lipase** to release free fatty acids



# Specimen collection and storage

- Fresh, **non-hemolyzed serum** from fasting patients is recommended.
- TG test needs **12 hours fasting** because its level is effected by meal (fatty meal, high carbohydrates meal)
- Triglycerides in serum appears stable for three days when stored at 2-8 °C.
- Prolonged storage of the samples at room temperature is not recommended since other glycerol containing compounds may hydrolyze, releasing free glycerol with an apparent increase in total triglycerides content.

# Normal range of TG

Level (mg/dl)	Interpretation
<150	Normal range, low risk
150-199	Borderline high
200-499	high
>500	Very high, high risk

# Causes of hypertriglyceridemia

There are many reasons why your triglyceride level may be high.

Some of them are due to **lifestyle habits** that increase triglyceride levels. These include:

- **Smoking**
- **Physical inactivity**
- **Being overweight or obese**
- **Increased alcohol consumption**
- **Eating a diet low in protein and high in carbohydrates**

# Causes of hypertriglyceridemia

There are also **medical conditions** that can cause high triglyceride levels, including:

- **Cirrhosis in the liver**
- **Diabetes, especially if it is not well controlled**
- **Genetic factors: as familial hypertriglyceridemia or combined hyperlipidemia**
- **Hypothyroidism**
- **Nephrotic syndrome or kidney disease**
- **Pancreatitis**
- **Drugs as corticosteroids and estrogen**

# Principle of Triglycerides measurement

- ❑ Measurement of triglycerides is based on determination of Light absorbance by the color compound formed. (**Quinoneimine** formation)
- ❑ Forms a Red Color compound
- ❑ The **intensity** of the red color is directly proportional to the **concentration of triglycerides** in the sample.
- ❑ It is determined by monitoring **light absorbance** at 505 nm

# Principle

The enzymatic reaction sequence employed in the assay of Triglycerides is as follows:

Triglycerides + H<sub>2</sub>O

**Lipase**

Glycerol + Fatty Acids

Glycerol + ATP

**Glycerol Kinase**

Glycerol-3-Phosphate + ADP

Glycerol-3-Phosphate + O<sub>2</sub>

**Glycerolphosphate oxidase**

Dihydroxyacetone + H<sub>2</sub>O<sub>2</sub>

H<sub>2</sub>O<sub>2</sub> + 4-aminoantipurin + 4 chlorophenol

**Peroxidase**

Quinoneimine Dye + 2H<sub>2</sub>O

# Principle

- The present procedure involves hydrolysis of triglycerides by **lipase** and the glycerol is then phosphorylated
- The glycerol concentration is then determined by enzymatic assay coupled with Trinder reaction that terminates the formation of a quinoneimine dye.

# Procedure

Concentration of the **standard** 200 mg/dl

Set up 2 test tubes as following , and then add:

Reagent	Test	Standard	Blank
Working solution	1ml	1 ml	1 ml
Pre-worm at 37°C for 2 min and add:			
Serum	10 µl	-	-
Standard	-	10 µl	-

Mix well, incubate at 37°C for 10min, then the absorbance of quinonimine produced is measured at 505 nm

# Concentration of TG

Use **Beer-Lambert equation** to receive to the concentration of

TG in the patient sample:

Conc. of TG (mg/dl):

$$C_{\text{test}} = \frac{A_{\text{test}}}{A_{\text{standard}}} \times C_{\text{standard}}$$

THANK YOU !

ANY QUESTIONS ??

PLEASE ASK