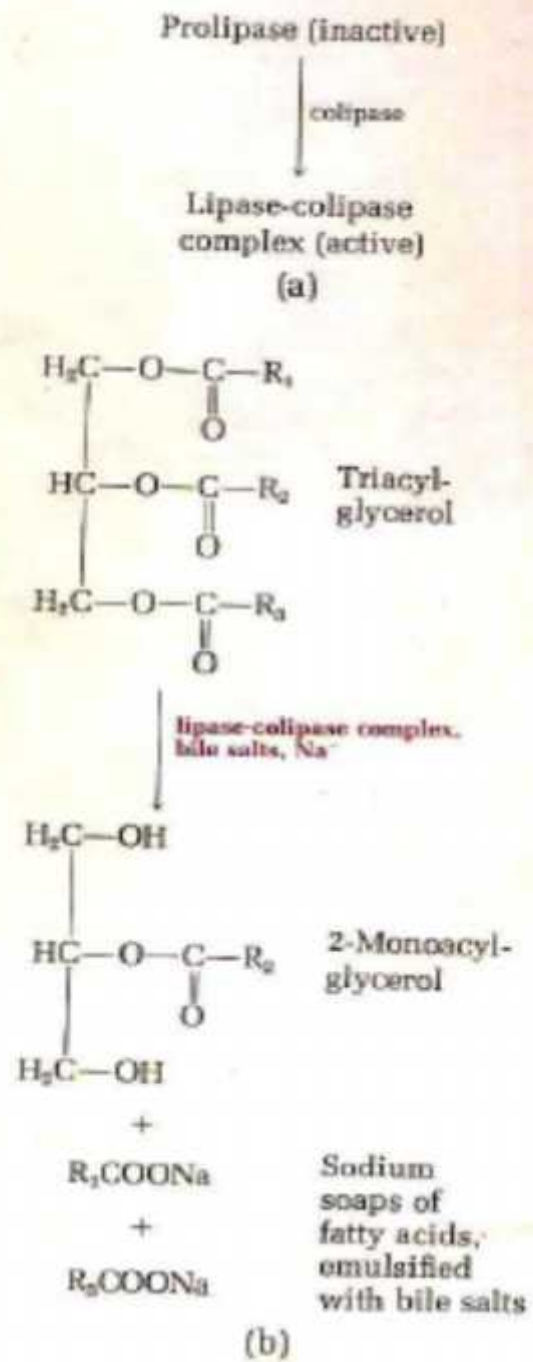


Digestion of Lipids

- Initiated by lingual & gastric lipases
 - Final digestion of TAG - in small intestine
 - **Prolipase** (zymogen) by pancreas
 - Activation by **Colipase** (protein) in the presence of bile salts
 - Lipase-colipase complex act on TAGs (**TriAcylGlycerols**)
-
- **Colipase** secreted by the pancreas
 - **Colipase** is secreted as zymogen procolipase
 - Activated in the intestine by trypsin

Figure 24-6

(a) Activation of lipase and (b) its action on triacylglycerols. (a) Prolipase, secreted by the pancreas, becomes active in the small intestine. Colipase is a small protein (MW 10,000) that binds to lipase and stabilizes the enzyme. (b) Triacylglycerols are hydrolyzed by lipase to yield 2-monoacylglycerol and the 1- and 3-acyl groups as fatty acid soaps. The reaction is aided by the bile salts, which emulsify the fatty acid soaps.



- Catalyze removal of one or more fatty acids
- Give a mixture of
 - free fatty acids as Na^+ or K^+ soaps
 - 2-MAG (2-monoacylglycerols)
 - small fraction of unhydrolyzed TAGs
- Fatty acid soaps & uncleaved TAGs emulsified into fine droplets by peristalsis
- **Peristalsis** - churning action of intestine aided by detergent effect of bile salts & MAGs (amphipathic mol.)
- FA & MAGs in droplets absorbed by intestinal cells

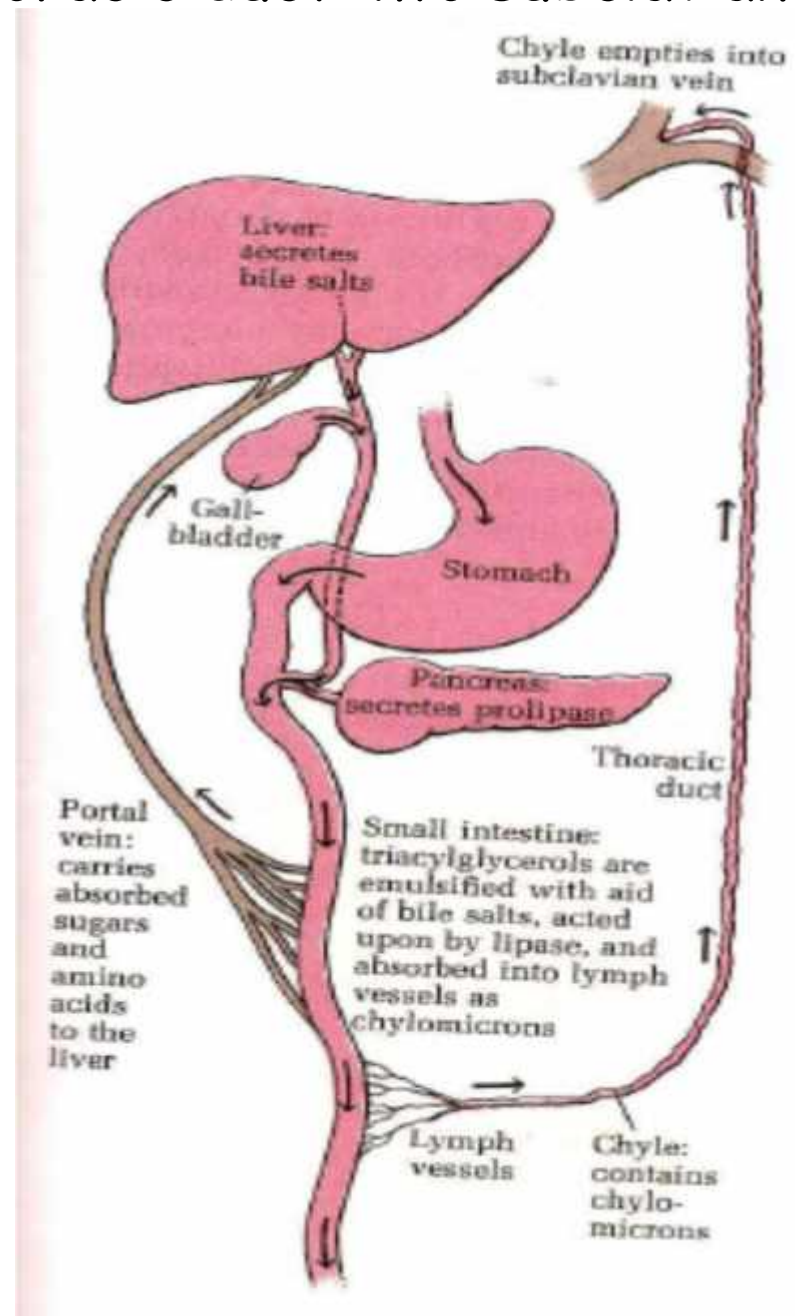
- Intestine- FA & MAGs reassemble into TAGs
- TAGs do not enter blood
- TAGs enter into **lacteals** (small lymph vessels in villi)
- Lymph draining small intestine called **Chyle**
- Chyle - milky appearance after fat-rich meal
- This appearance due to chylomicrons

Chylomicrons

1. Droplets highly emulsified TAGs (1 μm diameter)
2. Hydrophilic coat of phospholipids & proteins

- Chylomicrons pass from thoracic duct into subclavian duct

Figure 24-7
 Schematic drawing of the elements in fat digestion and absorption. Note that bile salts cycle from the liver to the small intestine and are then reabsorbed through the lymph vessels and portal vein and returned to the liver. Some of the bile salts are usually lost in the feces in each cycle.



- After fat rich meal - blood plasma appears **opalescent** (milky) due to high Conc. Of chylomicrons



- This appearance disappears in 1-2 hrs, as TAGs are removed from blood by adipose tissues

BILE SALTS

- Facilitate emulsification & digestion in small intestine
- Major human bile salts:
 - **Sodium glycholate**
 - **Sodium taurocholate**

- Both are Cholic acid derivatives
- **Cholic acid** - most abundant human bile acid

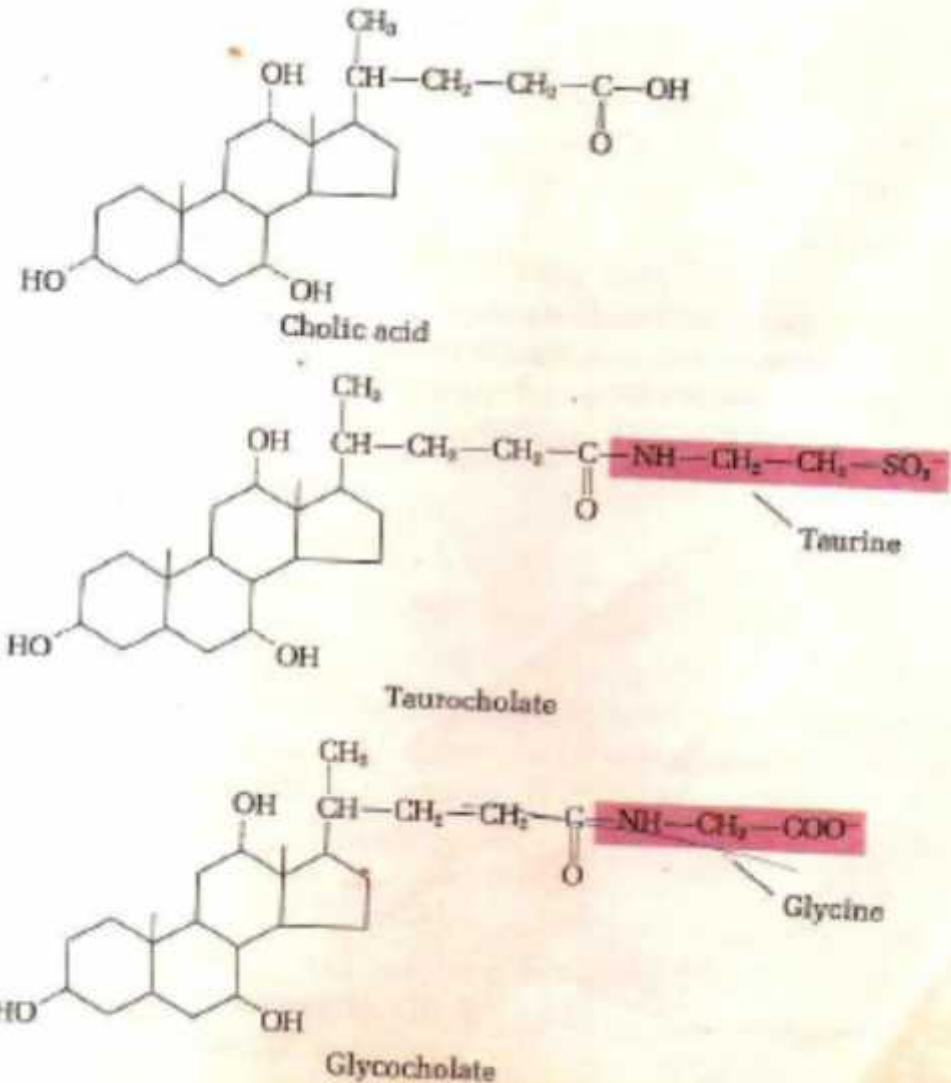


Figure 24-8

Cholic acid and its conjugated forms taurocholate and glycocholate. Because of their amphipathic qualities they are excellent detergents and emulsifiers. The glycine and taurine groups (color) are hydrophilic, while the steroid nucleus is hydrophobic.

Functions of bile salts

1. Emulsification

- Powerful emulsifying agents

(Lipids/fat globules are too big for it to be absorbed by the bloodstream. So it needs to be broken down to smaller form, so called fat droplets, with the aid of bile salts. Fats are too concentrated. If they are absorbed by the blood, it will blocked some of the capillaries)

- Secreted by **liver** into **bile**
- Bile delivers bile salts into upper portion of **small intestine**
- After emulsification, salts are **reabsorbed**
- Thus bile salts constantly **cycle bw liver & small intestine**

2. Absorption

- Extremely important in absorption of all fat-soluble nutrients & TAGs
- If bile salts **formation or secretion deficient**
- **Undigested, unabsorbed fats** appear in stool
- Fat-soluble vitamins (**A, D, E, K**) - not completely absorbed
- Deficiency of vit. A can result