DIETARY LIPID AND HEALTH EFFECTS

PHAR-432

LECTURE: 11

Assist. Lecturer: Alaa Amer Mohammad
Email : alaa.amer@tiu.edu.iq

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Outlines

- **Dietary lipids**
- **Health effects of fatty acids**
- **Olestra**
- **Diseases associated with dietary lipids**

LIPIDS

- The lipids are a heterogeneous group of compounds, including **fats**, **oils**, **steroids**, **waxes**, and **related compounds**.

- Like **glucose**, **lipids** are metabolically oxidized to **ATP,CO2 & H2O .**

- **Fatty acids** provide up to **30 %** of the total calorie requirements in humans on a normal diet. During **fasting**, they become virtually **sole** source of **energy**

DIETARY CONSIDERATIONS

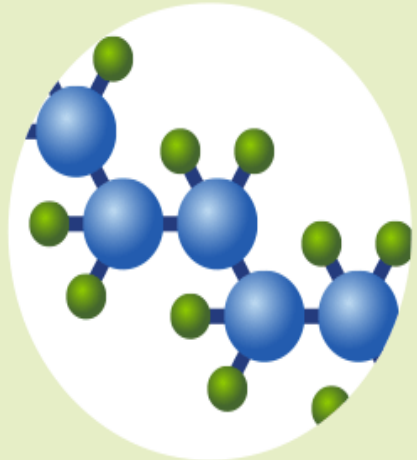
- More than 95% of the total fat intake is as TGs, with the remainder occurring in the form of PLs, free FAs, CH, and plant sterols.
- Large differences exist in the FA composition of oils from both plant and animal sources, largely because of genetic and environmental factors

TABLE 4.2 AVERAGE TRIGLYCERIDE FATTY ACID COMPOSITION OF IMPORTANT EDIBLE FATS[a]

		AVERAGE FATTY ACID COMPOSITION						
			SATURATED		MONOUNSATURATED AND POLYUNSATURATED			
FOOD (100 g)	AVERAGE FAT (%)	TOTAL[b]	16:0	18:0	18:1	18:2	18:3	20:4
Milk (cow) 3.25%	4	3	0.8	0.4	0.8	0.12	0.08	
Butter	81	51	22	10	20	3	0.3	
Lard (pig)	100	39	24	14	41	10	1	
Pork[c]	7	2.3	1.5	0.7	3	0.6	0.03	0.08
Tallow	100	50	25	19	36	3	0.6	
Beef[d]	9	3	2	1	4	0.3	0.05	0.04
Chicken[e]	16	3.3	3	0.6	6	3	0.1	
Egg	10	3	2	0.8	4	1	0.03	0.1
Turkey[f]	2	0.3	0.3	0.08	0.4	0.3	0.01	0.02
Sesame oil	100	14	9	5	39	39	0.3	
Soybean oil	100	15	11	4	23	51	7	
Corn oil	100	8	5	2	57	23	6	
Sunflower seed oil	100	9	4	4	57	29		0
Olive oil	100	14	11	2	7	10	0.8	0
Cottonseed oil	100	26	23	2.3	17	52	0.2	0.1
Safflower oil	100	6.2	4.28	2	14	75		
Palm oil	100	49	44	4	37	9	0.2	
Coconut oil	100	87[b]	8	3	6	2		
Palm kernel oil	100	82[b]	8	3	1	2		
Canola oil	100	7	4	2	62	19	9	
High oleic canola oil	100	7	3	2	70	15	23	
Cashew nut	44	8	4	3	24	8	0.06	
Walnut	65	6	4	2	9	38	9	
Herring (Atlantic)	9	2	1	0.1	2	0.1	0.1	0.06
Salmon (Atlantic)	13	3	2	0.5	3	1	0.2	0.09

Type of Fatty Acid	Double Bonds	Diagram
Saturated	None	
Monounsaturated	One	
Polyunsaturated	Multiple (>1)	

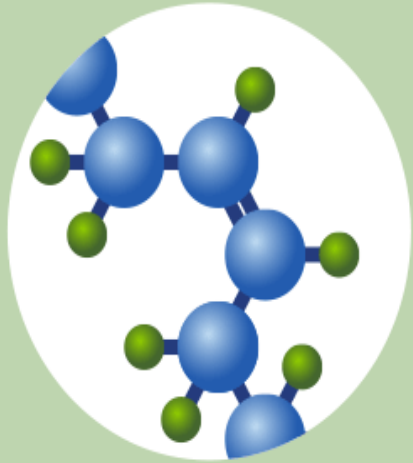
SATURATED FATS



SINGLE BONDS BETWEEN CARBONS

MAINLY SOLID AT ROOM TEMPERATURE

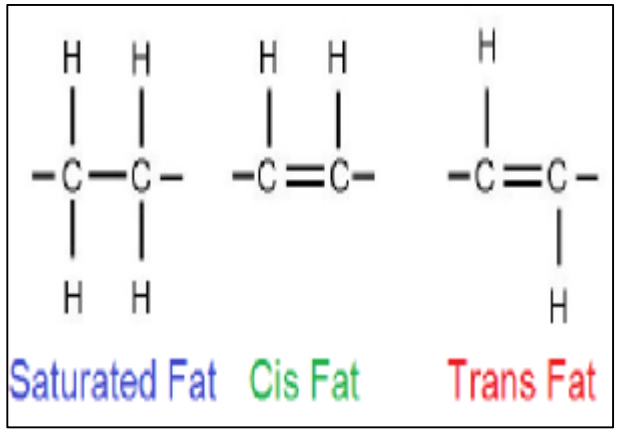
UNSATURATED FATS

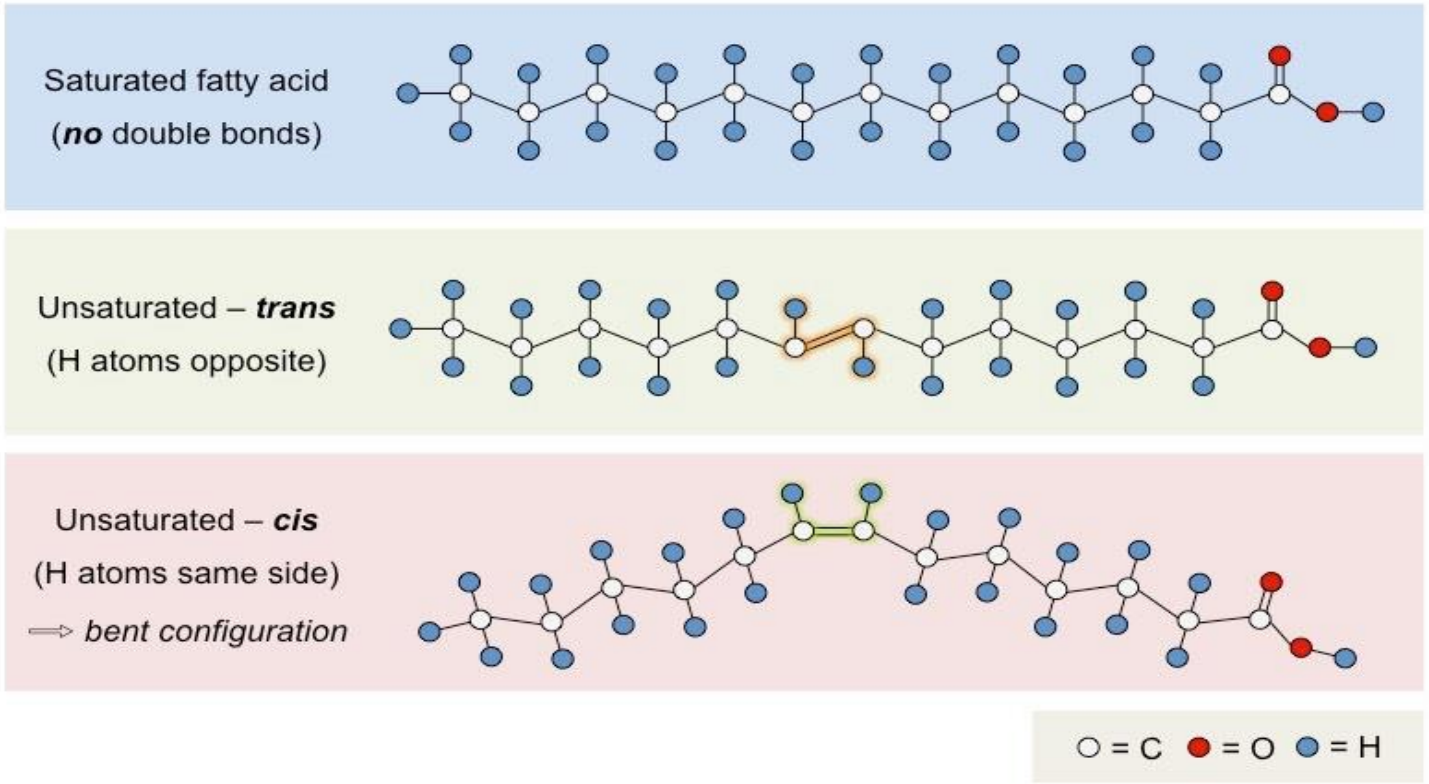


ONE OR MORE DOUBLE BONDS BETWEEN CARBONS

MAINLY LIQUID AT ROOM TEMPERATURE

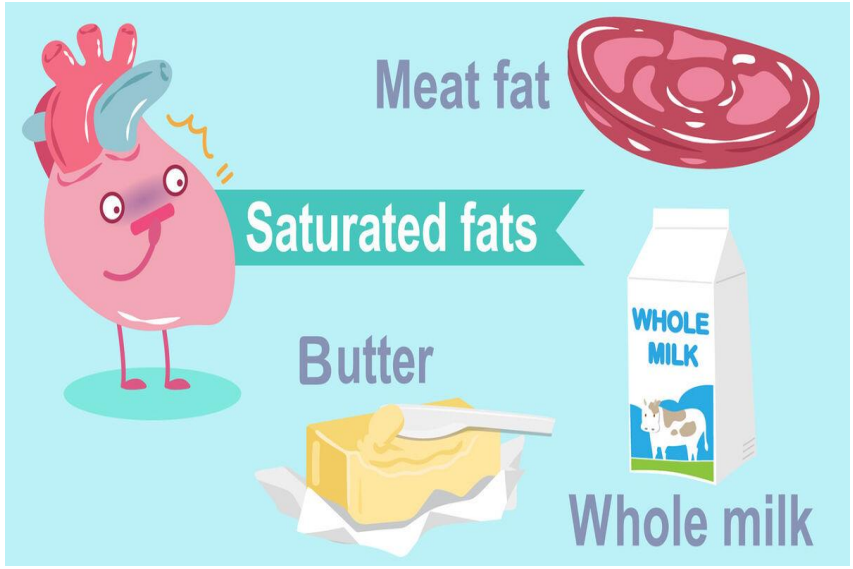
Cis. and Trans. isomer of unsaturated fatty acids





Effects of saturated fatty acids

1. Source of energy
2. In the food: usually accompanied with cholesterol (animal source)
3. Enhance the level of total cholesterol and LDL-cholesterol
4. Stable: auto-oxidation takes place at higher temperatures
5. Promote obesity and atherosclerosis



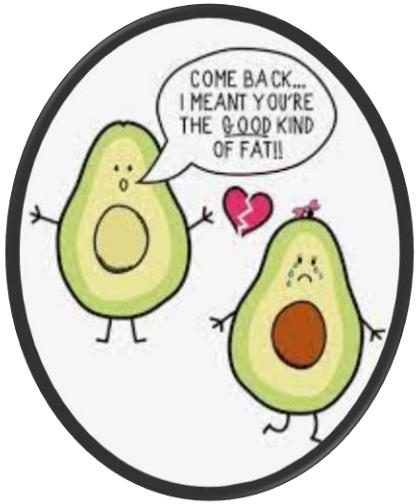
Note: Diet must contain limited amount of saturated fatty acids to reduce the disadvantages.

Effects of mono unsaturated fatty acids (Oleic acid (ω-9)

1. Source of energy
2. In the food: usually accompanied with cholesterol (Animal source)
3. Decreased LDL-cholesterol and maintain or increase HDL- cholesterol.
4. Mediterranean diet -decreased incidence of ischemic heart disease, fore that intake of oleic acid is recommended

Effects of polyunsaturated fatty acids especially linoleic acid (ω-6)

1. Decreased LDL-cholesterol
2. Vasoconstriction
3. Pro-inflammatory effects
4. Enhanced platelet aggregation



Effects of polyunsaturated fatty acids especially linolenic acid (ω-3)

1. Decrease in the level of VLDL and triacylglycerol
2. Vasodilation
3. Anti-inflammatory effects
4. Inhibition of platelet aggregation

Effects of trans fatty acids

Trans fatty acids elevate LDL-C and lower HDL-C, thereby increasing the risk of CHD.


OMEGA FATS & FOOD SOURCES
Omega 3
WILD SALMON, TROUT, SARDINES, WALNUTS, CHIA, FLAX
PHARMAVITE
Omega 6
SOY OIL CORN OIL, SAFFLOWER OIL, SUNFLOWER OIL, AVOCADO
Omega 9
OLIVE OIL, AVOCADO, PEANUTS, ALMONDS

What is olestra?

- Manufactured fat replacers consist of chemical derivatives of carbohydrate, protein, or fat, or modified versions of foods rich in those constituents.
- A familiar example of an artificial fat that has been approved for use in snack foods such as potato chips, crackers, and tortilla chips is olestra.
- **Olestra's** chemical structure is similar to triglyceride but with important differences.
- A triglyceride is composed of a glycerol molecule with three fatty acids attached, whereas olestra is made of a sucrose molecule with six to eight fatty acids attached.
- Enzymes in the digestive tract cannot break the bonds of olestra, so unlike sucrose or fatty acids, olestra passes through the system unabsorbed.

Essential Fatty Acid Deficiency

- ❑ Irritated & flaky skin
- ❑ GI problems
- ❑ Impaired immune system
- ❑ Slow growth for children
- ❑ kidney damage
- ❑ Decreased resistance to stress

Carnitine deficiency

Carnitine is an amino acid that is naturally produced in the body. It plays a critical role in energy production. It is an essential cofactor that helps transport long chain fatty acids into the mitochondria. It is important for heart and brain function, muscle movement.

Carnitine deficiencies:

- Muscle weakness
- Brain dysfunction
- Heart dysfunction

Questions

1. What is fatty liver?

Fatty liver is the excessive accumulation of fat primarily TGs in the liver parenchymal cells. The Liver is not a storage organ for fat, but it contains about 5% fat. But in this condition may be goes up to 25-30% and is known as fatty liver. When the accumulation of lipids in the liver becomes chronic, fibrotic changes occur in cells which may finally lead to cirrhosis and impairment of liver function.

2. What causes fatty liver?

Causes of fatty liver

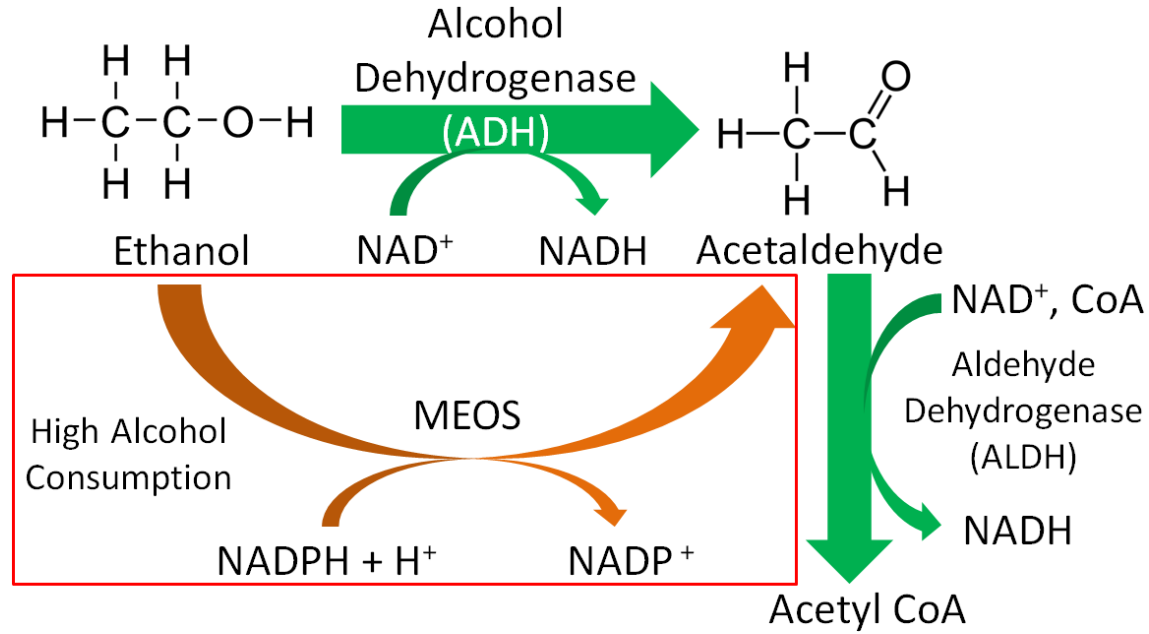
- It occurs in conditions in which there is an imbalance between hepatic TGs synthesis and the secretion of VLDL.

Conditions that cause fatty liver

1. High-fat diet
2. Starvation, uncontrolled DM, or insulin insufficiency
3. Alcoholism
4. High cholesterol intake
5. Use of certain chemicals

3. How does alcohol lead to fatty liver?

Ethanol intake generates too much NADH and decrease NAD+, resulting in the inhibition of important processes that required NAD+ (gluconeogenesis and fatty acid oxidation, TCA cycle), cause increase TG and cholesterol synthesis.



MEOS – Microsomal Ethanol Oxidizing System

4. What are the first signs of liver damage from alcohol?

1. Fatigue
2. Abdominal pain and discomfort
3. Pain in the area of your liver
4. Unexplained weight loss
5. Skin changes

5. What are the side effects of drinking too much alcohol?

- High blood pressure
- Heart disease
- Stroke
- liver disease
- Digestive problems
- Cancer

6. How do you prevent fatty liver? What substances will prevent fatty liver?

Dietary intake of (Essential fatty acids, Essential amino acids, Vitamin E and selenium, Lipotropic factors)

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