FAT

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By the end of this lecture, student can:

- Define what is lipid/fat
- Explain the structure, roles and metabolism of lipid/fat
- Discuss the deficiency and excess intake of lipid/fat
The important nutrient for source of calories.

One gram fat supplies 9 calories.

Also needed to carry and store essential fat-soluble vitamins, i.e: vitamin A and D.

Two basic types of fat
  - Saturated Fat
  - Unsaturated Fat

Used differently in our bodies and has a different effect on our health.
CHARACTERISTICS

• Lipid/fat: hydrophobic – insoluble in water
  ◆ Animal fats are solid
    • Bacon fat, lard, butter
    • Use for long term energy storage, protection of organs & insulation
    • 3 x higher than carbohydrate
    • Padding around organs
    • Resists heat transfer

• Vegetables fats are liquid
  ◆ Oils – olive oil, corn oil, coconut oil
1. Saturated Fat
   - Mainly found in animal foods, but a few plant foods are also high in saturated fats.
   - Single bond.
   - The fat solid at room temperature.
   - Eat too much saturated fat, it increases chances of getting heart disease, coronary artery disease and fats build up in the lining of arteries.
   - Butiric acid (4), Miristic acid (14), Palmitic acid (16), Stearic (18)
UNSATURATED FATS

- Usually liquid at room temperature. Beneficial fats.
- Double bond.
- Predominantly found in plant foods.
  - Mono unsaturated fatty acid (MUFA) (1 double bond)
    - Oleic acid (18C)
  - Poly unsaturated fatty acid (PUFA) (2 and more double bond)
    - Linoleic acid (2 double bond) (18C)
    - Linolenic acid (3 double bond) (18C)
    - Arachidonic acid (5 double bond) (20C)
    - Called as essential fatty acid
- They are found in most vegetable products and oils.
- Using foods containing polyunsaturated and monounsaturated fats does not increase our risk of heart disease.
- Omega 3...Omega 6???
TRANS FATS

- Made by heating liquid vegetable oils in the presence of hydrogen gas and catalyst, HYDROGENATION.
- More stable, less likely become rancid.
- Can withstand repeated heating without breaking down, ideal for frying fat foods.
- Also naturally found in beef fat and dairy fat in small amounts.
TRANS FATS

• Worse for cholesterol levels than saturated fats:
  – Raise bad LDL and lower good HDL
  – Create insulin inflammation
  – Contribute to insulin resistance
  – Harmful health effects even in a small amounts
Cholesterol

• Needed by our bodies for our cells, nerves and brain.
• Important in forming hormones and enzymes.
• Human can make all the cholesterol their need in the livers.
• Also can get from the food that we eat.
• Eat too much cholesterol or eat too many foods that contain cholesterol or saturated fat, the level of blood cholesterol increases. Higher chances of developing heart disease.
• Cutting the amount of cholesterol we eat may only have a small effect on blood cholesterol.
FAT DIGESTION

- The goal of fat digestion is to dismantle triglycerides into small molecules that the body can absorb:
  - Monoglycerides
  - Fatty acids
  - Glycerol

- **In the Mouth**
  - Start off slowly, some fats beginning to melt when they reach body temperature.
  - Salivary gland releases an enzyme (lingual lipase), which plays a small role in fat digestion in adults and an active role in infants.
  - In infants, this enzyme digests the short and medium chains fatty acids in milk.

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**Lipid digestion and absorption**

The bulk of our dietary lipids are triglycerides, which need to be digested before they can be absorbed. The diet also contains smaller amounts of phospholipids, which are partially digested, and cholesterol and fat-soluble vitamins, which are absorbed without digestion.

**Ask Yourself**

1. Where are micelles formed?
2. Which of the following is not part of a micelle?
   - a. Fatty acids
   - b. Monoglycerides
   - c. Bile
   - d. Triglycerides

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1. A small amount of lipid digestion occurs in the mouth due to salivary lipase and in the stomach due to gastric lipase.
2. The liver produces bile, which is stored in the gallbladder and released into the small intestine to aid in the digestion and absorption of fat.
3. The pancreas produces the enzyme pancreatic lipase, which is released into the small intestine to break down triglycerides into fatty acids and glycerol.
4. In the small intestine, the products of fat digestion and bile form micelles, aggregations of fat molecules in droplet form, that can move close enough to the brush border to allow lipids to diffuse into the mucosal cells. In the large intestine, unabsorbed fat is metabolized by bacteria. Very little fat is normally lost in the feces.
5. Inside the mucosal cells, fatty acids are reassembled into triglycerides and incorporated into lipid transport particles, which enter the lymph.
FUNCTION OF FAT

• Providing and storing energy.
• Supplying essential fatty acids.
  – Linoleic fatty acids.
  – Linolenic fatty acids.
• Insulating the body.
  – Helping to maintain the body’s temperature.
• Carrying fat soluble vitamin.
• Contributing flavor and aroma.
• Increasing fullness value of food.
• Aiding formation of cell membranes and prostaglandins (hormone that stimulate specific process in the body)
HEALTH EFFECTS OF LIPIDS

• Heart disease
  – Elevated blood cholesterol is a major risk factor for cardiovascular disease.
  – Cholesterol accumulates in the arteries cause restricting blood flow and raising blood pressure.

• Risks from Saturated fats
  – Increase LDL cholesterol – heart disease

• Risks from Trans-fats
  – Raise LDL and lower HDL cholesterol, heart disease, cancer (need research)
HYDROGENATION PROCESS

• A chemical process by which hydrogens are added to monounsaturated or polyunsaturated

• The process of hydrogenation adds hydrogen atoms to cis-unsaturated fats, eliminating double bonds and making them into partially or completely saturated fats.
  
  – To reduce the number of double bonds
  – Making fats more saturated (solid)
  – More resistant to oxidation

• Hydrogenation produces trans-fatty acids
THANKS....