

LIPIDS

OBJECTIVES/RATIONALE

Knowledge of nutrients is important in understanding energy production and use. The student will identify lipids and relate their use by the body to health and wellness.

TEKS 121.24 1C, 6A

TAKS ELA 1, 3, 4, 5, 6
Science 2, 4

KEY POINTS

I. Lipids - Fats

- A. Triglycerides – 99% of the stored lipids in the body are triglycerides
 - 1. made up of fats and oils.
 - 2. provide a continuous source of energy.
 - a. have more C and H bonds available to break than carbohydrates.
 - b. Provides 9 kcalories per gram
 - 3. help to insulate the body and protect it from shock.
 - 4. carry vitamins A, D, E and K (fat soluble) in food
 - 5. spares protein from being broken down to provide energy
 - 6. Chemical structure
 - a. made of C, H, and O
 - b. each triglyceride is made up of a glycerol molecule and three fatty acids.
 - c. Fatty acids – found mainly as part of a triglyceride
 - aa. organic compound made of long chains of C's with H's attached. Can have 4 to 24 C in the chain. (most common fatty acids found in foods have 18 C in their chain.)
 - bb. Have an acid group (COOH) at one end and a methyl group (CH₃) on the other.
 - cc. Saturated fatty acids – the C chain is fully loaded with H's. (No C - C double bonds are in the chain.)
 - dd. Unsaturated fatty acids – the C chain has H's missing and there are C - C double bonds in the chain. May occur as mono- or poly- unsaturated.
 - ee. Point of unsaturation is important in nutrition (where the C-C double bond is located) Omega 3 and Omega 6
 - ff. Most common fatty acids
 - Stearic acid – saturated
 - Oleic acid – mono-unsaturated
 - Linoleic acid – poly-unsaturated
 - Linolenic acid – poly-unsaturated
 - gg. Hydrogenation – turns an unsaturated fatty acid into a saturated one by adding H's to the C chain.

B. Phospholipids

1. Are an important component of cell membranes.
2. Aid in the movement of fat soluble substances back and forth across the cell membrane.
3. Act as emulsifiers
4. Has a glycerol backbone and two fatty acids. The third site is bonded to a phosphate group and a molecule of choline.

C. Sterols

1. contribute to cellular structure
2. serve as raw material for some hormones, vitamin D, bile and cholesterol.
3. Cholesterol is the most notable sterol made and used by the body.

II. Lipids in the body

A. Digestion

1. Purpose of digestion is to break large compounds into smaller ones that the body can absorb and use for energy.
2. Mouth
 - a. Some hard fats begin to melt
 - b. Lingual lipase initiates the breakdown of lipids in adults, but little in infants.
3. Stomach
 - a. Little digestion takes place.
 - b. Fat is hydrophobic so it floats on the other stomach contents.
4. Small intestine
 - a. A hormone (cholecystokinin) causes the gallbladder to release bile, which acts as an emulsifier helping to mix the fats with other food contents.
 - b. Major fat digesting enzyme is pancreatic lipase from the pancreas.
 - c. Some lipases are also produced in the small intestine.
 - d. Lipases hydrolyze (break apart) the triglycerides and phospholipids into smaller molecules to be absorbed.
 - e. Most hydrolysis of fats occurs in the small intestine.

B. Absorption

1. Very small pieces of digested fat can be absorbed into the bloodstream
2. Large units must be absorbed into the lymph vessels (lacteals)
 - a. lipoprotein carriers are used to transport fats.
 - aa. Chylomicrons – transport diet-derived lipids from the intestines to the rest of the body.
 - bb. VDL – Very low density lipoprotein
Transports lipids made in the liver to other parts of the body.
 - cc. LDL – Low density lipoprotein
Cells take triglycerides, cholesterol and phospholipids from LDL's to build cell structures and make new compounds.
Referred to as “BAD” cholesterol.
 - dd. HDL – High density lipoproteins

Made by the liver to transport cholesterol and phospholipids from the cells back to the liver to be disposed of or recycled. Referred to as “GOOD” cholesterol.

III. Lipids and health

- A. Adipose tissue - the body’s fat tissue
 - 1. Excess energy taken in by the body is stored as fat by the body
 - 2. Storage of fat depends mainly on energy intake and output.
 - 3. Fat is the easiest nutrient for the body to use in storing fat. Smaller units are absorbed and recombined as fat.
- B. Essential fatty acids – fatty acids our bodies must have but cannot make.
 - 1. Omega 3
 - 2. Omega 6
 - 3. Deficiencies can retard growth, cause reproductive failure, skin lesions, kidney problems, liver, kidney and visual problems and even neurological disorders.
 - 4. To prevent a deficiency, fats should make up at least 3% of the daily caloric intake.
- C. Health risk
 - 1. Fats are associated with more chronic diseases than any other nutrient
 - 2. Diets high in fats have been linked to
 - a. Heart disease
 - aa. High levels of cholesterol in blood (LDL) is a major risk in heart disease. Saturated fats raise LDL’s. Polyunsaturated fats lower LDL’s. *Trans*-fatty acids raise LDL’s.
 - bb. It accumulates in the arteries and restricts blood flow raising BP.
 - b. Cancer
 - aa. there is an association of some types of cancer with fats in the diet. The link is not as strong as in heart disease.
 - bb. Although fat may not be the primary cause it has been shown to promote cancer growth.
 - cc. May be a strong link between prostate cancer and saturated fat from meat and milk.
 - c. Obesity – people who eat high fat diets tend to exceed their energy requirements and gain weight.

ACTIVITIES

- I. Create 3-D models of lipids.
- II. Prepare a multimedia report comparing and contrasting the lipoprotein carriers LDL and HDL as they relate to health and wellness.

MATERIALS NEEDED

Assorted materials for model
Library

Internet

ASSESSMENT

Completion of the model

Multimedia Rubric

ACCOMMODATIONS

For reinforcement, the student will make a poster depicting lipid use by the body.

For enrichment, the student will research the link between trans fatty acids and breast cancer.

REFLECTIONS
