UNIT 3: MACRO NUTRIENTS

LIPIDS

Lipids are defined as a set of chemical molecules formed of fatty acid or exhibit fat-like structure, insoluble in water and soluble in alcohol, ether, and chloroform.

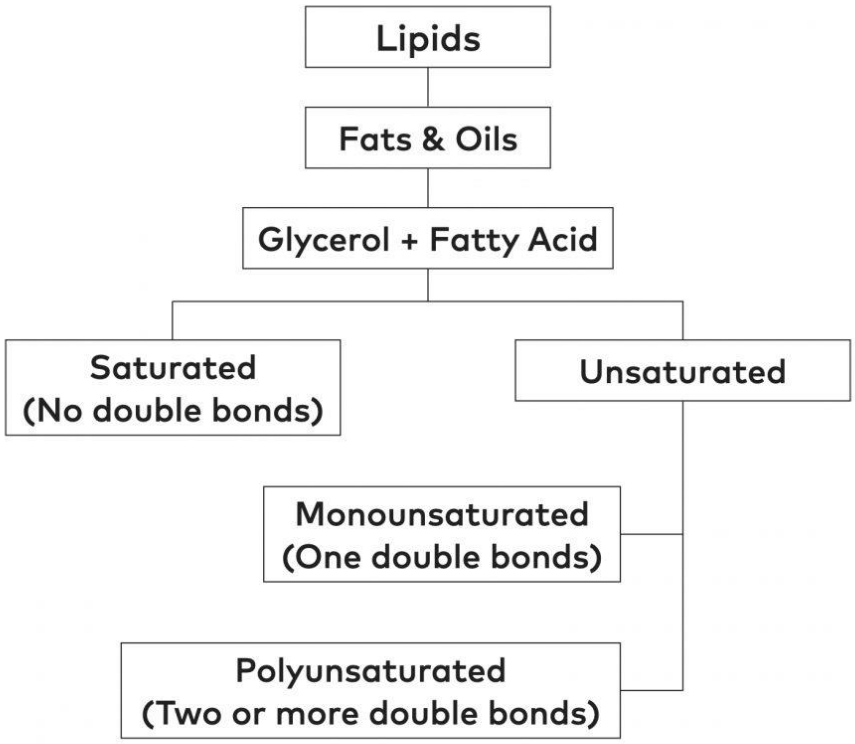
- The basic use of fats and oils in cookery is to add richness and flavour to food and as a cooking medium to fry or cook food. They improve the texture of various preparations such as cakes, pastries, and biscuits.
- Fats and oils are found in plants, animals and marine foods.
- They are organic compounds composed of C, H, and O
- Collectively known as Lipids.
- Immiscible in water but soluble in an organic solvent. (Ether, Chloroform, Benzene, and Acetone)
- Unlike carbohydrates – contains a small proportion of O and a larger proportion of H and C
- Provide more energy per gram than carbohydrates.

Healthy Lipids

Lipids important to health:

- Fatty acids
- Fats
- Oils
- Phospholipids
- Lipoproteins
- Sterols

Classification of Lipids



Saturated Fatty Acids

- Fats that are tightly packed are called saturated fats.
- There are some exceptions, but most are solid at room temperature.
- These are found in animal foods such as meat, butter, cheese, and egg yolk and plant foods such as coconut oil, palm oil, and cocoa butter.
- Hydrogenated fats used in bakery products and confections have a high percentage of saturated fatty acids.
- Stearic acid, palmitic acid, myristic acid, and butyric acid are some of the saturated fatty acids.
- A maximum of 10% of our total calories should come from saturated fats.

Sources of Saturated Fat

Red meat, some pork and chicken products, Dairy products including butter, shortening, and cheese

A diet high in saturated fat may raise your low-density lipoprotein (LDL)cholesterol levels. This will raise your risk of heart disease and type 2 diabetes.

Saturated Fatty Acids present in some food items

Fatty Acids	Food Source
Acetic acid	Vinegar
Butyric acid	Butter
Caproic acid	Butter
Lauric acid	Palm kernel, Coconut
Myristic acid	Coconut, Butter
Palmitic acid	Palm, Soya, Sesame, Cotton seed, Butter, Lard
Stearic acid	Beef, Tallow, Cocoa Butter, Lard
Caprylic acid	Coconut, Palm kernrl

Unsaturated Fatty Acids

Unsaturated fats are loosely packed. They tend to be liquid at room temperature. Replacing saturated fat with unsaturated fat can improve your health. Unsaturated fat comes from plants.

It's found in: vegetable oils, olives, nuts and seeds, some fish

Two main types of unsaturated fat

Monounsaturated fats

Monounsaturated fats can help improve your cholesterol levels and lower your risk of cardiovascular disease. It may also help you control your insulin levels and blood sugar.

Foods containing monounsaturated fats: olive oil, peanut oil, canola oil, avocados, most nuts, most seeds

Polyunsaturated fats

Our body needs polyunsaturated fats to function. This type of fat helps with muscle movement and blood clotting. Since your body doesn't make it, you have to get it in your diet.

Polyunsaturated fats can be further divided into two types:

1. omega-3 fatty acids

Omega-3 fatty acids are beneficial to the heart.

Omega-3 fatty acids can be found in: fatty fish, such as sardines, tuna, salmon, trout, mackerel, and herring; ground flax and flaxseed oil; non-hydrogenated soybean oil; safflower oil; sunflower oil; canola oil; walnuts; sunflower seeds; chia seeds; hemp seeds

2. omega-6 fatty acids

Omega-6 fatty acids may also help protect against cardiovascular disease. But there's a debate about the inflammatory role of omega-6's.

Omega-6 fatty acids can be found in: safflower oil; soybean oil; sunflower oil; walnut oil; corn oil

Research has found that repeatedly heating oils can decrease their antioxidant activity and increase free radical production, which may lead to poor health effects. Avoid overheating or burning of oils to keep their nutrient content.

Essential Fatty Acids

- EFAs are a special type of "good fat". They are also essential nutrients; sometimes called vitamin F.
- Essential nutrients are necessary for life but must be obtained through diet because the body cannot make them.
- EFAs are required for the proper structure and function of every cell in the body and are important for optimal health.
- EFAs increase the absorption of vitamins and minerals; nourish the skin, hair, and nails; promote proper nerve functioning; help

produce hormones; ensure normal growth and development; and prevent and treat disease.

- Linoleic acid (omega-6) and alpha-linolenic acid (omega-3) are two primary EFAs.

Classification of saturated fats and unsaturated fats:

The following are the kinds of fats, their dietary sources, and effects:

Type of Fat	Dietary Source	State at Room Temp.	Effects
Monounsaturated	Mustard Oil, Canola Oil, Walnut Oil, Avocado Oil, Groundnut Oil, Almond Oil	Liquid	Lowers the level of bad cholesterol and increase the level of good cholesterol
Polyunsaturated	Corn Oil, Soybean Oil, Safflower Oil, Cotton Seed Oil, Fish Oil, Flax Oil	Liquid	Lowers the level of bad cholesterol and increase the level of good cholesterol
Saturated	Whole Milk, Butter, Cheese, Desi Ghee, Coconut Oil, Chocolate	Solid	Increase the level of bad cholesterol and decrease the level of good cholesterol

Dietary Sources of Lipids

- Most foods except the bread cereal group and the vegetable fruit group (except olives and avocado) contain varying percentages of lipids.
- Some fats are visible such as fats and oils added to food or used for frying.
- Many sources are hidden or invisible such as the fats and oils naturally present in the food, e.g., milk, egg yolk, oily fish, and meat.
- Both visible and invisible sources must be taken into account while calculating the fat content of a meal.

Plant sources

All oils and oilseeds like groundnut, sesame, soya bean, rice bran, coconut, almond, cashew nut, corn, safflower, sunflower, and all hydrogenated fats and margarine are sources of lipids.

Animal sources

Mutton, pork, fish, poultry, milk, and milk products such as butter, cream, yogurt, cheese, eggs, and organ meats.

Invisible sources

Invisible sources of fats are nuts, salad dressings, flesh food, desserts, cookies, cakes, milk, eggs, milk-based sweetmeats, etc., which are rich in fat, but the fat is not visible.

Functions

Lipids in biological systems function either as a source of stored metabolic energy or as structural matrices and permeability barriers in biological membranes.

Provide Energy

Although the main source of energy for our bodies is carbohydrates, fat is used as a source of backup energy in cases when carbohydrates are not available.

This is a concentrated energy source but it is important to remember that each gram of fat has nine calories (over double the calories from protein and carbohydrates) so you should avoid having more than 20 to 35% of your daily calories from fat.

In an 1,800-calorie diet, you should only consume 40-70 grams of fat.

Absorb Vitamins

Certain vitamins, which are known as fat-soluble, need fat to be absorbed and stored. Some examples include vitamin A, vitamin D, vitamin E and vitamin K, all of which are an essential part of anyone's daily diet.

Vitamin A is responsible for promoting good vision and keeping our eyes healthy; vitamin D helps us absorb calcium; vitamin E neutralized free radicals, protecting cells in the process; and vitamin K is essential for blood clotting.

If you don't have enough fat in your body, you become deficient in one or more of these vitamins.

Store Fat for Subsequent Use

Our bodies can also store fats to be used later on. If you consume food that includes more energy than the body needs to perform its

normal functions, any excess food is stored as subcutaneous fat under the skin. Sometimes this adipose tissue will be stored in the thighs and stomach, causing lumpy patches. The body also stores fats around our vital organs to help protect them from outside impacts or any sudden movements.

Maintain Proper Body Temperature

You can also find a thin fat layer located right underneath the skin. This layer of fat is designed to insulate the body, keeping heat inside and therefore helping us maintain the proper body temperature. In addition to insulating, this layer of fat can also protect the inner core from extreme temperature changes. That is because when our skin temperatures significantly drop, our fat deposits will generate and then release heat which helps increase the temperature.

Protect Your Body

The body also has a layer of fat that is surrounding major organs (including the brain and heart), nerves, tissues and bones and this is designed to act as a protective cushion. If for some reason you experience a sudden impact or even severe trauma, this layer of fat will absorb as much of the shock as it can so it can protect these essential organs and structures from being significantly damaged.

Hair and Skin

Fat also helps maintain healthy hair and skin. That is because it helps our bodies absorb increased amounts of vitamin A, vitamin D, vitamin E, and vitamin K through the bloodstream. That is why dry, flaky skin is a symptom of a deficiency in fatty acids. Subcutaneous fat (which is found just under the skin) not only helps round the skin but also helps insulate the body, regulating body temperature in the process.

Cholesterol

- It is a fat-like substance present in food.
- It is different in structure from triglycerides, as it has a ring structure. It is present in all cells of the body and large amounts in the brain and nerve tissue.
- Cholesterol, if consumed in excess is responsible for diseases of the cardiovascular system.
- The normal blood cholesterol level for adults should be below 200mg/100ml blood.

The human body gets cholesterol from two sources:

Synthesis in the liver

Food rich in cholesterol (meat, poultry and full-fat dairy products)

Two main forms of Cholesterol

LDL (low-density lipoprotein)

LDL cholesterol is often referred to as “bad cholesterol” because too much is unhealthy.

HDL (high-density lipoprotein)

HDL is often referred to as “good cholesterol” because it is protective.

Dietary Cholesterol

Dietary cholesterol is found in animal-based products including meat, fish, eggs, as well as poultry and dairy. Red meat will have more cholesterol than chicken and fish, but shrimp and eggs have been known to be the worst cholesterol culprits of the group.

Blood cholesterol

Lipoproteins carry cholesterol in the blood. The two main types that carry cholesterol to and from cells are called low-density lipoproteins (LDL-C) and high-density lipoproteins (HDL-C).

The lower the density of the lipoproteins the more fats it contains. High-density lipoprotein (HDL cholesterol) is called the 'good cholesterol' because it helps to keep cholesterol from building up in the arteries. Low-density lipoprotein (LDL cholesterol) is called the 'bad cholesterol' because it is the main source of cholesterol build-up and blockage in the arteries. Statin medication work to reduce this LDL-C.

Deficiency of fats

- Leads to the deficiency of essential fatty acids (linoleic and linolenic)
- Poor body temperature regulation
- Dryness of skin
- May lead to fat-soluble vitamin deficiency
- Loss of your menstrual cycle
- Extreme mental fatigue

Excessive intake

- Causes obesity
- Excess fat is stored in adipose tissue
- Atherosclerosis
- Constipation
- Cardiovascular diseases

RDA

Fat should not contribute more than 30% Kcal

Saturated fat – not more than 10%

Tips to consume healthy forms of fat

Remove these foods:	Replace them with these foods:
Butter, Stick, Margarine, and Cream Cheese	Oil-based dressings and Spreads
Sour Cream and Ice-Cream	Low-fat plain or Greek Yogurt
Whole milk	Slim or Low-fat milk or Plant milk (Soy, Almond, Flax, Hemp)
Pizzas, Processed meats, Fatty meats, Fried chicken, or other Skin on chicken dishes	Lean cuts of meat, Poultry, Sea-food, and fish
Deserts, Baked Goods, and Processed Snacks	Whole grains, Fruits, Vegetables and Nuts