FOOD AND NUTRITION FINAL ASSIGNMENTS

1. Imagine you have identiﬁed people in your community who are suffering from vitamin A deﬁciency, iodine deﬁciency disorder and iron deﬁciency anaemia. What can you do to address these problems?

#### Strategies for the prevention of Vitamin A deficiency

#### -Promotion and support exclusive breastfeeding up to six months of age

#### -Vitamin A supplementation (VAS)

#### -Dietary fortification

* **Strategies for the prevention of Iodine deficiency disorder.**

-Universal iodization of salt for human and animal consumption

-Supplementation of iodine capsules to populations in areas where iodine deficiency is very common

* **Strategies for the prevention of iron deficiency anaemia**

**-**Supplementation of iron and folic acid for pregnant and lactating women

**-**Supplementation of Iron to children and adolescents

1. a) What is the impact of malnutrition on communities?

Just as malnutrition has many causes, its effects are also multidimensional in nature.

* ***Increased risk of disease and death-***Malnutrition, sub-optimal infant feeding practices, and vitamin A deficiency, significantly lower the resistance to infections and dramatically increase the risk of illnesses and death. Millions of children die of severe acute malnutrition each year.
* ***Low productivity of the malnourished individuals--***Stunting has a serious impact on the productivity of individuals. Stunted children grow up to become less productive adults. Studies show that labour productivity declines as severity of stunting increases. Iodine deficiency also significantly reduces the productivity of an individual.
* ***Poor school performance and attendance--***Proper nutrition is essential for mental and physical development and for school performance. Malnutrition reduces children’s learning ability, school performance and attendance. Iodine deficiency lowers the ability of children to think and become creative and productive adults. Iodine is necessary for the normal development of the brain of the fetus during pregnancy.
* ***Poverty perpetuation (a vicious circle)--***Malnutrition affects children, women, and communities and will prevent them from reaching their full mental and physical capacity. As stated earlier on, a malnourished child will grow to a malnourished adult. The productivity of the adult will be decreased and poverty will continue.
* ***Intergenerational cycle of malnutrition-***-As seen earlier, malnutrition has an intergenerational cycle. A malnourished mother will give birth to a low birth weight baby; the low birth weight baby will grow as a malnourished child, then to a malnourished teenager, then to a malnourished pregnant woman, and so the cycle continues.

b) How can you help prevent some of the negative effects of malnutrition?

* ***Basic education***: This is a very important for improving child nutrition and care. Therefore advocacy should be done to promote equal chances of education for both boys and girls since this is important to enable them to become better parents themselves.
* ***Healthy environment***: Availability and easy access to safe and adequate water for drinking, cooking and cleaning are important aspects of each person’s development and the maintenance of their health.
* ***Maternal and childcare***: Prevention of prematurity, proper antenatal care and promotion of good feeding practices are important interventions that may help to decrease malnutrition within a community.
* ***Healthy social and family life***: Strong family planning services may help families to limit the number of children they have; social integration and communal care may support orphans and children with special needs.
* ***Proper agriculture***: Diversification through planting the right number of different kinds of seeds should be promoted, and food distribution at household level should be equitable, giving children and pregnant mothers priority.
* ***Public health measures****:* These include prevention and treatment of maternal infections during pregnancy and delivery. Immunizations against preventable diseases as well as an emphasis on growth promotion and monitoring activities are also important public health strategies to prevent malnutrition in the community. Part of my role includes working with other professionals and community leaders to help promote these strategies and help improve the nutritional status of people living in my community.

1. Describe and explain the digestion and absorption of carbohydrates
2. **Digestion**

## **In the Mouth**

Carbohydrate digestion begins in the mouth. The salivary glands in the mouth secrete saliva, which helps to moisten the food. The food is then chewed while the salivary glands also release the enzyme salivary amylase, which begins the process of breaking down the polysaccharides in the carbohydrate food.

## **In the Stomach**

After the carbohydrate food is chewed into smaller pieces and mixed with salivary amylase and other salivary juices, it is swallowed and passed through the esophagus. The mixture enters the stomach where it is known as chyme. There is no further digestion of chyme, as the stomach produces acid which destroys bacteria in the food and stops the action of the salivary amylase.

## **In the Pancreas and Small Intestine**

After being in the stomach, the chyme enters the beginning portion of the small intestine, or the duodenum. In response to chyme being in the duodenum, the pancreas releases the enzyme pancreatic amylase, which breaks the polysaccharide down into a disaccharide, a chain of of only two sugars linked together. The small intestine then produces enzymes called lactase, sucrase and maltase, which break down the disaccharides into monosaccharaides. The monosaccharaides are single sugars that are then absorbed in the small intestine.

## **In the Large Intestine (Colon**)

Carbohydrates that were not digested and absorbed by the small intestine reach the colon where they are partly broken down by intestinal bacteria. Fiber, which cannot be digested like other carbohydrates, is excreted with feces or partly digested by the intestinal bacteria.

1. **Absorption**

The cells in the small intestine have membranes that contain many transport proteins in order to get the monosaccharides and other nutrients into the blood where they can be distributed to the rest of the body. The first organ to receive glucose, fructose, and galactose is the liver. The liver takes them up and converts galactose to glucose, breaks fructose into even smaller carbon-containing units, and either stores glucose as glycogen or exports it back to the blood. How much glucose the liver exports to the blood is under hormonal control and the glucose itself regulates its concentrations in the blood via a process called negative feedback. An everyday example of negative feedback. Besides, your body senses blood glucose levels and maintains the glucose “temperature” in the target range. The glucose thermostat is located within the cells of the pancreas. After eating a meal containing carbohydrates glucose levels rise in the blood. Insulin-secreting cells in the pancreas sense the increase in blood glucose and release the hormonal message, insulin, into the blood. Insulin sends a signal to the body’s cells to remove glucose from the blood by transporting to the insides of cells and to use it to make energy or for building macromolecules. In the case of muscle tissue and the liver, insulin sends the biological message to store glucose away as glycogen. The presence of insulin in the blood signifies to the body that it has just been fed and to use the fuel. Insulin has an opposing hormone called glucagon. As the time after a meal increases, glucose levels decrease in the blood. Glucagon-secreting cells in the pancreas sense the drop in glucose and, in response, release glucagon into the blood. Glucagon communicates to the cells in the body to stop using all the glucose. More specifically, it signals the liver to break down glycogen and release the stored glucose into the blood, so that glucose levels stay within the target range and all cells get the needed fuel to function properly

1. What is nutrition? List the main functions of nutrients.

**Nutrition**--is the science that interprets the interaction of nutrients and other substances in food in relation to maintenance, growth, reproduction, health and disease of an organism. It includes food intake, absorption, assimilation, biosynthesis, catabolism, and excretion.

**Functions of nutrients**

* Provide energy such as carbohydrates, fats & proteins
* Build & repairs body tissues such as proteins
* Regulates body process such as minerals, vitamins & water

1. What is the importance of calcium? Name and explain the two factors that enhance and

that interfere with the absorption of iron in the body.

**Importance of calcium**

* Bone & teeth health maintenance
* Nerves transmission
* Muscle contractions
* Blood clotting

**Factors increasing iron absorption**

* Conditions associated with a higher Apoferritin level in mucosal cells of the small intestine: These includes the following
* After hemorrhage: this causes & increased rate of blood cell formation which puts excessive demands on the iron stores of the body. The ferritin of the intestinal mucosal cells (as well as that of other body tissues) gives up iron thus liberating apoferritin
* Iron deficiency anemia: Here again apoferritin content of the intestinal mucosal cell is high
* Ongoing to high altitudes: this also causes & increased red cell formation which results in depletion of iron contained in ferritin & thus liberates apoferritin in the intestinal mucosal cells
* Repeated administration of iron: this stimulates the synthesis of apoferritin in the intestinal mucosal cells & thus iron absorption is increased. Unnecessary iron medication over prolonged periods can thus lead to excessive iron absorption which may be harmful
* Taking ascorbic acid, succinic acid & sorbitol along with iron: Ascorbic acid favors reduction of Fe+++ to Fe++;the latter is more readily absorbed
* Intake of inorganic iron: more iron is absorbed if it is ingested in inorganic form
* Pathological conditions: hemochromatosis is a pathological condition in which an unknown mechanism causes an increased rate of iron absorption. The excess of iron thus absorbed is deposited in body tissues which interferes with their functions. In this disease body iron content may be up to 50grams as against a normal content of only 3-5grams. More iron is also absorbed in cirrhosis,portacaval shunts & some forms of pancreatic insufficiency
* Administration of cobalt & erythropoietin & the later stages of pregnancy

**Factors inhibiting iron absorption**

* Malabsorption syndrome: These include steatrorrhea,sprue & celiac disease
* Diarrhea diseases: In these conditions there is less time for iron absorption
* An excess of phosphates, oxalates or phytic acid: These form complexes with iron which are insoluble & cannot be absorbed. Vegetable food have an excess of phosphates & interfere with iron absorption
* Subtotal gastrectomy: These is interference with the reduction of Fe+++ with normal occurs mainly in the stomach
* Surgical removal of the upper small intestine: This results in a loss of surface concerned with iron absorption because most of the iron is normally absorbed here.
* Food intake along with iron: Less medicinal iron is absorbed if ingested along with food especially eggs because of the formation of insoluble iron complexes.
* Antacid therapy: Iron absorption is also decreased by a simultaneous intake of antacids;achlorhydria has also the same effect
* Chronic infections can also be the cause

1. . Discuss two reasons why it is essential to include carbohydrates in your diet. Why is it necessary for the body to spare protein?
2. **2 Reasons for essential carbohydrate in diet**

* **Carbohydrates are the best form of energy--** Carbohydrates are an important part of a healthy diet and provide the body with the fuel it needs for physical activity and for proper organ function. There are two types of carbohydrates—complex and simple. Complex carbohydrates come naturally from fruits, vegetables, legumes and whole grains. Simple carbohydrates come from sugars, which are typically processed and contain no significant nutrients
* Carbohydrate aids digestion-- E.g. most (vegetables, whole, grains,fruits,etc). Fibrous Carbohydrates are rich sources of vitamins, minerals, photochemical & other nutrients tend to be green vegetables. These are full of fiber, which is the indigestible portion of plant material .This means that much of the food passes straight through the gut & is not absorbed thus they are great “colon cleansers’ & are essential for keeping the digestive process running clean & healthily. Besides, fibrous carbohydrates are very low in calories & it’s virtually impossible to overeat on green vegetables. Some vegetable are so low in calories they contain less than it requires to eat.

1. **Spare-proteins**

Fats, carbohydrates and proteins are all integral components of our diet, each playing a role in our body functions. Proteins and carbohydrates, however, play a larger part in energy production. **Carbohydrates** are said to **spare proteins** because our body uses carbohydrates for energy instead of proteins, according to Richard Stockton College Athletic Training. As a result, our body uses proteins for other purposes, such as rebuilding muscles, making enzymes or producing antibodies. Understanding how proteins and carbohydrates work together can ensure that you have enough energy, especially for athletic performance

1. Discuss the role of lipids in our diet and their critical functions in the body.

## **Source of energy production and storage**

The primary role of lipids in our body is to provide energy for muscles and body processes. Fat is energy dense. About half of the fuel our body needs when at rest or during everyday activity comes from lipids. If you consume more calories than you need in a day, the excess energy is stored as lipids in adipose cells. In between meals and during exercise our body relies on these fats stores to provide energy

## **Acts as insulation and protection**

Lipids are also used to insulate and protect our body. You have a layer of fat just below skin that helps to keep the internal body temperature regular despite the external temperature. Our vital organs, such as the kidneys, have a layer of fat around them that acts like bubble wrap to protect them from injury. Without this lipid layer, every bump and bruise could hurt our organs.

## **Aids digestion and absorption**

Lipids in our body are essential for proper digestion and absorption of food and nutrients. Bile acids produced from lipids in the liver allow fat and water to mix in intestines and aid in the breakdown and absorption of food. Lipids are then needed to transport the fat-soluble vitamins, A, D, E and K, from the intestines to the blood stream. The cells use these vitamins to maintain the health of our vision, skin, bones, teeth and blood, according.

## **Provide cell wall structure**

The essential lipids, linolenic acid and linoleic acid, are vital to our health; they cannot be made in our body and must come from the diet. They are used in the production of cell membranes and hormones, as well for maintaining vision and supporting the immune system. These lipids provide structure and support for the walls of every cell in our body. Communication between cells is also dependent upon lipids in our cells' membranes.

## **Hormone production**

Cholesterol is a type of lipid needed to produce important steroid hormones in the body. Estrogen, testosterone, progesterone and the active form of vitamin D are all formed from cholesterol and are needed to maintain pregnancy, develop sex characteristics and regulate calcium levels in our body. According to the American Heart Association, about 25 percent of the cholesterol in our blood comes from our diet, from animal foods such as egg yolks, cheese and shrimp, and the other 75 percent is formed in our liver and cells.

1. Explain the importance of fats to the bioavailability of other nutrients

The bioavailability of nutrients are determined by both dietary and physiological factors;

**Physiological factors**;

* The physical form of the nutrient within the food structure and the ease with which the nutrient can be released from that structure
* The chemical form of the nutrient in a foodstuff and its solubility in the lumen
* The presence of proteolytic enzyme inhibitors (commonly associated with legumes such as soybeans) which reduce the body's ability to digest protein; and
* The presence of enzymes such as thiaminase which partially hydrolyzes thiamin and makes it less biologically active.

**Diet-related factors include:**

* Food structure
* Physicochemical form of the nutrient
* Enhancers of absorption, e.g., ascorbate (for iron), some organic acids, sugars, amino acids, bulk lipid (for fat-soluble vitamins), and specific fatty acids
* Inhibitors (primarily of inorganic micronutrient absorption), e.g., phosphates (especially phytate), polyphenols (including tannins), and oxalate

However, the bioavailability of macronutrients – carbohydrates, proteins, fats – is usually very high at more **than 90%** of the amount ingested. On the other hand, micronutrients, i.e. vitamins and minerals, and bioactive phytochemicals can vary widely in the extent they are absorbed and utilized.

## **Storing Energy**

The excess energy from the food we eat is digested and incorporated into adipose tissue, or fatty tissue. Lipids primarily function as an energy reserve. Alternatively, fats are packed together tightly without water and store far greater amounts of energy in a reduced space. A fat gram is densely concentrated with energy—it contains more than double the amount of energy than a gram of carbohydrate. Energy is needed to power the muscles for all the physical work and play an average person or child engages in. For instance, the stored energy in muscles propels an athlete down the track, spurs a dancer’s legs to showcase the latest fancy steps, and keeps all the moving parts of the body functioning smoothly. Unlike other body cells that can store fat in limited supplies, fat cells are specialized for fat storage and are able to expand almost indefinitely in size. An overabundance of adipose tissue can result in undue stress on the body and can be detrimental to our health. A serious impact of excess fat is the accumulation of too much cholesterol in the arterial wall, which can thicken the walls of arteries and lead to cardiovascular disease. Thus, while some body fat is critical to our survival and good health, in large quantities it can be a deterrent to maintaining good health.

## **Regulating and Signaling**

Triglycerides control the body’s internal climate, maintaining constant temperature. Those who don’t have enough fat in their bodies tend to feel cold sooner, are often fatigued, and have pressure sores on their skin from fatty acid deficiency. Triglycerides also help the body produce and regulate hormones. For example, adipose tissue secretes the hormone leptin, which regulates appetite. In the reproductive system, fatty acids are required for proper reproductive health. Women who lack proper amounts may stop menstruating and become infertile. Omega-3 and omega-6 essential fatty acids help regulate cholesterol and blood clotting and control inflammation in the joints, tissues, and bloodstream. Fats also play important functional roles in sustaining nerve impulse transmission, memory storage, and tissue structure. More specifically in the brain, lipids are focal to brain activity in structure and in function. They help form nerve cell membranes, insulate neurons, and facilitate the signaling of electrical impulses throughout the brain.

## **Insulating and Protecting**

Up to **30%** of body weight is comprised of fat tissue? Some of this is made up of visceral fat or adipose tissue surrounding delicate organs. Vital organs such as the heart, kidneys, and liver are protected by visceral fat. The composition of the brain is outstandingly **60%** fat, demonstrating the major structural role that fat serves within the body. You may be most familiar with subcutaneous fat, or fat underneath the skin. This blanket layer of tissue insulates the body from extreme temperatures and helps keep the internal climate under control. It pads our hands and buttocks and prevents friction, as these areas frequently come in contact with hard surfaces. It also gives the body the extra padding required when engaging in physically demanding activities such as ice- or roller skating, horseback riding, or snowboarding.

## **Aiding Digestion and Increasing Bioavailability**

The dietary fats in the foods we eat break down in our digestive systems and begin the transport of precious micronutrients. By carrying fat-soluble nutrients through the digestive process, intestinal absorption is improved. This improved absorption is also known as increased bioavailability. Fat-soluble nutrients are especially important for good health and exhibit a variety of functions. Vitamins A, D, E, and K—the fat-soluble vitamins—are mainly found in foods containing fat. Some fat-soluble vitamins (such as vitamin A) are also found in naturally fat-free foods such as green leafy vegetables, carrots, and broccoli. These vitamins are best absorbed when combined with foods containing fat. Fats also increase the bioavailability of compounds known as phytochemicals, which are plant constituents such as lycopene (found in tomatoes) and beta-carotene (found in carrots). Phytochemicals are believed to promote health and well-being. As a result, eating tomatoes with olive oil or salad dressing will facilitate lycopene absorption. Other essential nutrients, such as essential fatty acids, are constituents of the fats themselves and serve as building blocks of a cell.

1. Discuss the role of fats as an energy source for the body

Fat is an important component of a diet designed to fuel exercise. One gram of dietary fat equals **9** calories, and one pound of stored fat provides approximately **3,600** calories of energy. This calorie density (the highest of all nutrients), along with our seemingly unlimited storage capacity for fat, makes it our largest reserve of energy. While these calories are less accessible to athletes performing quick, intense efforts like sprinting or weight lifting, fat is essential for longer, slower, lower intensity and [endurance exercise](https://www.verywellfit.com/sports-nutrition-for-endurance-exercise-3120671), such as easy cycling and walking.

### **Understanding Fat**

Everything we eat is made up of macro and micronutrients that are converted to energy inside the body, helping to fuel all of our bodily functions. Dietary fat has been blamed for many health problems, but it is actually an essential nutrient for optimal health. Adipose tissue (stored fat) provides cushion and insulation to internal organs, covers the nerves, moves vitamins (A, D, E, and K) throughout the body, and is the largest reserve of stored energy available for activity. Stored body fat is different from dietary fat. Body fat is only stored in the body when we consume more calories than we use, from any and all foods we eat, not just from dietary fats. There is **an**[**optimal level of body fat**](https://www.verywellfit.com/what-is-body-composition-3495614) for health and for athletic activity.

### **How the Body Uses It**

Fat provides the main fuel source for long duration, low- to moderate-intensity exercise (think endurance sports such as marathons). Even during high-intensity exercise, where​carbohydrate is the main fuel source, fat is needed to help access the stored carbohydrate (glycogen).Using fat to fuel exercise, however, is dependent upon these important factors:

* Fat is slow to digest and be converted into a usable form of energy. (It can take up to six hours for this to occur.)
* After the body break down fat, it needs time to transport it to the working muscles before it can be used as energy.
* Converting stored body fat into energy takes a great deal of oxygen, so exercise intensity must decrease for this process to occur.

For these reasons, athletes need to carefully time when and how much fat they eat. In general, it’s not a great idea to eat foods high in fat immediately before or during intense exercise. Aside from the fact that the workout will be done before the fat is available as usable energy, doing so can cause some uncomfortable gastrointestinal symptoms, such as nausea, vomiting, and diarrhea.

### **Popular Diets That Use Fat as the Main Fuel Source**

Popular low-carbohydrate and high-fat diets, such as the Ketogenic diet and Paleo diet, all work on the premise that lower carbohydrate intake, coupled with high fat and moderate to high protein intake leads to burning body fat as the main fuel source while exercising.

There is, in fact, some scientific evidence that shows long-term low-carb/high-fat diets to be safe and possibly helpful in improving metabolic risk factors for chronic disease. In studies, these diets have shown to be beneficial for performance in ultra-endurance sports while at least several months of adaptation to a low-carb/high-fat diet are required for metabolic changes to occur.

1. Define chylomicron. Describe the role of bile salts in the digestion of triacylglycerols and phospholipids.
2. **Chylomicrons--**are lipoprotein particles that consist of triglycerides, phospholipids, cholesterol, and proteins. They transport dietary lipids from the intestines to other locations in the body.
3. The role of the bile salts

Bile salts help binding of lipase with two molecules of colipase.The combination of the two enhances lipase activity in the intestinal ph which helps in emulsification of fats. Calcium precipitates FFA as insoluble Ca soaps & facilitates lipase action. Absorption of lipids is due to mixed **micelle** formation. Bile salts & soaps formed in the intestinal lumen & bicarbonate of pancreatic & intestinal juices collected in the higher FA, mono & diglycerides, lecithins, cholesterol in form of water soluble molecular aggregates called “**micelles**” Micelles are absorbed mainly from duodenum & jejunum. Bile salts are absorbed in the lower part of the intestine & return to liver via portal vein & resecreted into the bile known as **enterohepatic** circulation.

* **Ttriacylglycerols** (TGL) also known as triglycerides in which glycerol is esterifies to three fatty acids such as saturated fatty acid e.g. stearic acid,mono unsaturated fatty acid e.g. oleic acid & polyunsaturated fatty acid e.g.linoleic acid.

These are the oils & fats of the diet which provide between 30-45% of average energy intake

* **Steroids** including cholesterol & variety of plant sterols & stanols & extremely small amounts of steroid hormones. Chemically these are completely different from triacylglycerols and phospholipids, and are not a source of metabolic fuel.
* **Phospholipids** (**PL**) in which glycerol are esterified to two fatty acids with phosphate & a hydrophilic group esterified to carbon-3. Phospholipids are major constituents of cell membranes