MAR GREGORIOS COLLEGE OF ARTS & SCIENCE

Block No.8, College Road, Mogappair West, Chennai – 37

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DEPARTMENT OF ELECTRONICS & COMMUNICATION SCIENCE

SUBJECT NAME: BASICS OF NUTRITION

SUBJET CODE: SNG2H

SEMESTER: II

PREPARED BY: PROF.S.FABBIYOLA

SYLLABUS

BASICS OF NUTRITION :

(This paper will be offered for common knowledge and to help its application to one's own health)

Introduction:Overview of Nutrition; Assessment of Nutritional Status - Dietary Reference Intakes and Diet-planning Guides - Overview of Digestion and assimilation Nutritional Elements: (at introductory level only) The Carbohydrates: Sugar, Starch, and Fibre - The Lipids: Fats, Oils, Phospholipids, and Sterols - Protein and Amino Acids - The Vitamins - Water and the Minerals - Metabolism of Nutrients and Energy Balance Diet and Diseases: A balanced dietary requirement – Nutritional Deficiencies and impacts - Introduction to Chronic Diseases, Obesity, and Diabetes - Cardiovascular Diseases – Role of diet in these diseases - Diet and Cancer - Vegetarian Diets, Alcohol, Caffeine, and Sugar.

Overview of Nutrition

Nutrition is the process of consuming food and having the body use it as raw materials for growth, fuel, and function. Nutrition comprises nutrients, reasons to eat healthy, ways to eat smart, and much more.

Benefits of a Nutritious Diet

A healthy diet will give your body the right amount of energy, enough raw materials, and all the "little helpers" you need to stay healthy. Good nutrition will also provide phytochemicals and antioxidants that will help keep you feeling young, looking great, and perhaps even disease-free.

A healthy diet includes lots of fruits and vegetables, some whole grains, high-quality protein, enough dairy or other calcium sources, and a bit of healthy fat.

While you don't want to deny yourself a few treats and the foods you love, it's best to cut back on unhealthy foods that are high in sugar, fat, sodium, and calories. That's where portion control comes in handy. Eating right looks easy enough on paper (or on a computer screen). But if you haven't been doing it for some time, it can be difficult to get back on track.

Macronutrients

The foods you eat provide the energy your body needs to work. Just like you need to put fuel in your car or recharge your cell phone battery, your body needs to be fed food that provides it with energy every day.

Carbohydrates

Glucose is the body's favorite form of energy. Carbohydrates are broken down into glucose as well as fructose and galactose. If you don't get enough carbohydrates, your body can make

glucose from protein through a process called gluconeogenesis. If you consume too many carbohydrates, your body will convert them into fat, and store them in your adipose tissue.

Fiber is another form of carbohydrate, but it does not break down into sugars. Fiber is present in all plant foods and is important in the digestive process. Fiber can help both regulate blood sugar and lower cholesterol. In turn, this may help prevent heart disease, some cancers, and obesity.

Protein

Protein comes from foods you eat and is broken down into individual amino acids. The body uses these amino acids to build and repair the various parts of itself. Also, muscles contain lots of protein, which needs to be replenished through diet. The body even uses protein in its immune system, hormones, nervous system, and organs.

Amino Acid Functions, Benefits, and Food Sources

Fats

The body also needs dietary fats. Fats are part of the structural building blocks of the body. They are also responsible for absorption of fat-soluble vitamins, hormone signaling, growth and brain development, and are important for maintaining hair and skin health. The body can also use fat for fuel, especially during bouts of exercise.

Eating Fat Keeps us Fit and Healthy

Micronutrients

Micronutrients—the vitamins and minerals you get from your diet—are just as important as the carbohydrates, protein, and fats (even though you only need them in small amounts).

Micronutrients usually function as co-enzymes, which means they help speed up some of the body's chemical reactions.

A few of the micronutrients the body needs to function include:

- **B-complex vitamins** helps convert carbohydrates for energy.
- **Vitamin A** promotes vision.
- **Vitamin C** helps to keep connective tissue strong and the immune system functioning.
- **Vitamin D** is essential for proper calcium uptake.
- **Zinc** is involved in many metabolic processes.

Calcium is probably the best known dietary mineral. It has several functions in the body. But the reason you hear or read about calcium so much is that lots of it are stored in your bones and teeth. Therefore, you need it from your diet to keep your bones and teeth strong. Another mineral you've probably heard a lot about is iron. Although you don't need as much iron as calcium, it's essential for your cells to get enough oxygen.

Your diet needs to provide adequate amounts of all of these "little helpers." And a healthy, balanced diet will give you lots of vitamins and minerals. An unhealthy diet may make the body deficient in one or more of them.

Antioxidants and Phytochemicals

Good nutrition provides more than energy, structural components, vitamins, and minerals. Antioxidants are the phytochemicals in fruits and vegetables (responsible for the bright colors). Some vitamins and amino acids even function as antioxidants as well.

Antioxidants help protect the body from damage that comes from the sun, pollution, smoke, and poor dietary choices.

Phytochemicals are antioxidants found in plant-based foods. Although they aren't

required for body function, they may have a very powerful impact on your health. For example, quercetin (found in red apples) operates like an antihistamine and has an anti-inflammatory effect.

Assessment Of Nutritional Status

Nutritional status is the current body status, of a person or a population group, related to their state of nourishment (the consumption and utilization of nutrients). The nutritional status is determined by a complex interaction between internal/constitutional factors and external environmental factors: Internal or constitutional factors like: age, sex, nutrition, behavior, physical activity and diseases.
External environmental factors like: food safety, cultural, social and economic circumstances.

An ideal nutritional status occurs when the supply of nutrients conforms to the nutritional requirements or needs.

Nutrient intake Requirements

Diets are rated in quality according to the balance of nutrients they provide, and not solely on the type of food eaten or the amount of caloric intake. People can have an optimal nutritional status or they can be under-, over- and/or malnourished .
The nutritional status of an individual has consequences:

An optimal nutritional status is a powerful factor for health and well being . It is a major, modifiable and powerful element in promoting health, preventing and treating diseases and improving the quality of life.

Malnutrition may increase risk of (susceptibility to) infection and chronic diseases , undernutrition may lead to increased infections and decreases in physical and mental development, andovernutrition may lead to obesity as well as to metabolic syndrome or type 2 diabetes.

Purpose of nutritional assessment

1) To Identify individuals or population groups at risk of becoming malnourished.

2) To Identify individuals or population groups who are malnourished

3) To develop health care programs that meet the community needs which are defined by the assessment.

4) To measure the effectiveness of the nutritional programs & interventions once initiated

Methods of Nutritional Assessment :

Nutrition is assessed by two methods; direct and indirect . The direct methods deal with the individual and measure objective criteria, while indirect methods use community indices that reflect the community nutritional status/needs.

Direct Methods of Nutritional Assessment :

These are summarized as ABCD.

1) Anthropometric methods
2) Clinical methods
3) Dietary evaluation methods
4) Biochemical, laboratory methods

Indirect Methods of Nutritional Assessment :

Ecological variables including agricultural crops production ,Economic factors e.g. household income, per capita income, population density, food availability and prices ,Cultural and social habits,Vital health statistics: morbidity, mortality and other health indicators e.g., infant and under-fives mortality, Utilization of maternal and child health care services, fertility indices and sanitary conditions.

Direct Methods of Nutritional Assessment :

1. Anthropometric Methods :

Anthropometry is the measurement of body height, weight & proportions. It is an essential component of clinical examination of infants, children & pregnant women. These measurements are compared to the reference data (standards) of the same age and sex group, in order to evaluate the nutritional status. Although they indicate the nutritional status in general , still they are not used to identify specific nutritional deficiencies.They are used to evaluate both under & over nutrition .The measured values reflect the current nutritional status & don't differentiate between acute & chronic changes.

2. Clinical assessment :

It is an essential feature of all nutritional surveys. It is the simplest & most practical method of ascertaining the nutritional status of a group of individuals. It utilizes a number of physical signs, (specific & non specific), that are known to be associated with malnutrition and deficiency of vitamins & micronutrients. Clinical assessment includes Good nutritional history should be obtained General clinical examination, with special attention to organs like hair, angles of the mouth, gums, nails, skin, eyes, tongue, muscles, bones & thyroid gland. Detection of relevant signs helps in establishing the nutritional diagnosis .

Examples of illnesses caused by improper nutrient consumption

Vitamin-A deficiency - Xerophthalmia
Beriberi -Vitamin B1 (Thiamine) deficiency
Vitamin B2 Deficiency - (Ariboflavinosis)
Pellagra -Vitamin B3 (Niacin) Deficiency
Scurvy - (Vitamin C Deficiency)
Rickets - (Vitamin D deficiency)
Goitre- (Iodine deficiency disorder)
Marasmus Kwashiorkor - Protein energy malnutrition

Dietary assessment :

Nutritional intake of humans is assessed by five different methods. These are: 24 hours dietary recall ,Food frequency questionnaire, Dietary history since early life,Food dairy technique ,Observed food consumption ,Healthy diet.

1) 24 Hours Dietary Recall :A trained interviewer asks the subject to recall all food & drinks taken in the previous 24 hours. It is quick, easy & depends on short-term memory, but may not be truly representative of the person's usual intake.

2) Food Frequency Questionnaire :In this method the subject is given a list of around 100 food items to indicate his or her intake (frequency & quantity) per day, per week & per month. It is inexpensive, more representative & easy to use.

3) Diet history : The diet history aims to discover the usual food intake pattern of individuals over a relatively long period of time. It is an interview method composed of two parts. The first part establishes the overall eating pattern and includes a 24hr recall: questions such as What did you have for breakfast yesterday?What do you usually have for breakfast?Subjects are asked to estimate portion sizes in household measures with the aid of standard spoons and cups, food photographs or food models.

   The second part is a detailed list of foods that are checked with the subject. Questions concerning food preferences, purchasing and the use of each food serve to verify and clarify information given in the first part. Questions about purchasing can also provide a check on portion estimates.

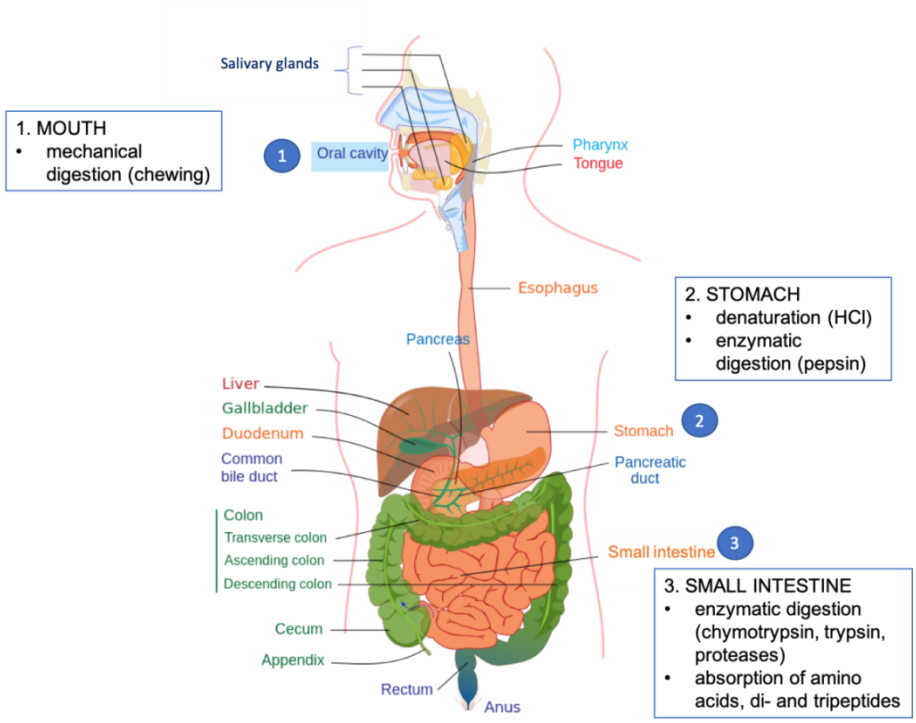
4) Biochemical Methods :Advantages of Biochemical Methods .It is useful in detecting early changes in body metabolism & nutrition before the appearance of clinical signs. It is precise, accurate and reproducible. Useful to validate data obtained from dietary methods e.g. comparing salt intake with 24-hour urinary excretion.
Limitations of Biochemical Methods :Time consuming,Expensive .They cannot be applied on large scale .Needs trained personnel & facilities.

Protein Digestion and Absorption

When you eat food, the body's digestive system breaks down dietary protein into individual amino acids, which are absorbed and used by cells to build other proteins and a few other macromolecules, such as DNA. Let's follow the path that proteins take down the gastrointestinal tract and into the circulatory system.

Eggs are a good dietary source of protein and will be used as our example as we discuss the processes of digestion and absorption of protein. One egg, whether raw, hard-boiled, scrambled, or fried, supplies about six grams of protein.

In the image below, follow the numbers to see what happens to the protein in our egg at each site of digestion.

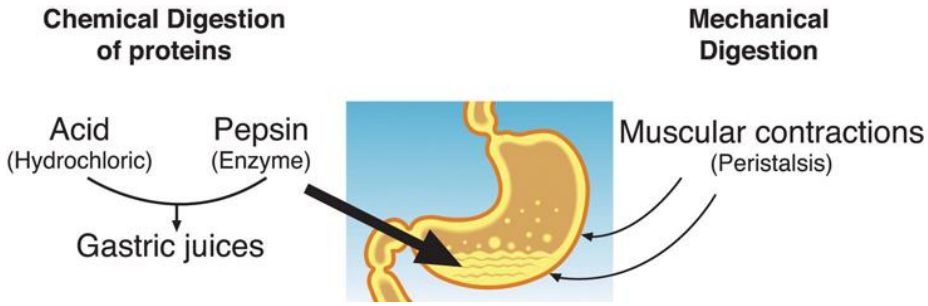


1 – PROTEIN DIGESTION IN THE MOUTH

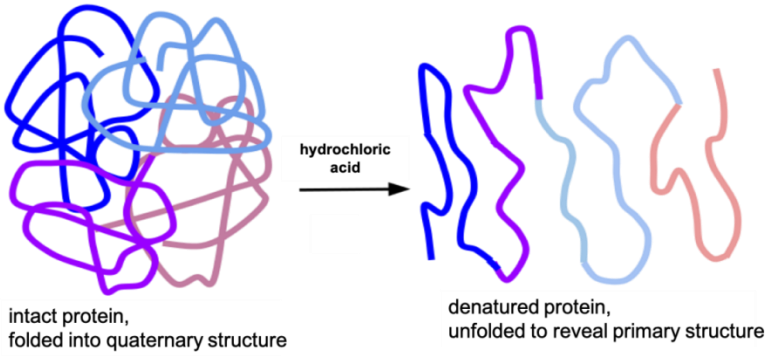
Unless you are eating it raw, the first step in digesting an egg (or any other solid food) is chewing. The teeth begin the **mechanical breakdown** of large egg pieces into smaller pieces that can be swallowed. The salivary glands secrete saliva to aid swallowing and the passage of the partially mashed egg through the esophagus.

2 – PROTEIN DIGESTION IN THE STOMACH

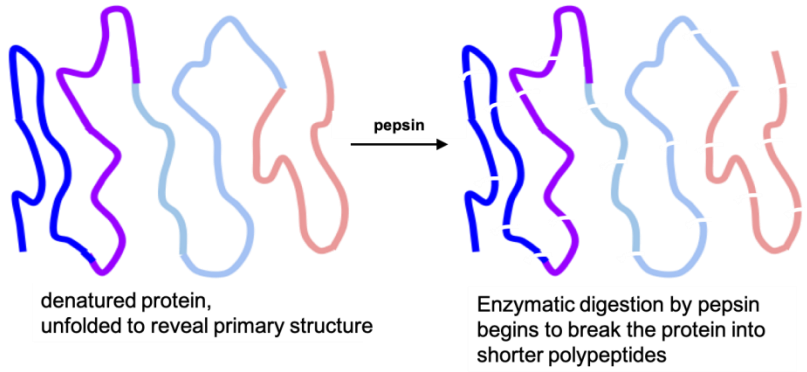
The mashed egg pieces enter the stomach from the esophagus. As illustrated in the image below, both mechanical and chemical digestion take place in the stomach. The stomach releases gastric juices containing ***hydrochloric acid*** and the enzyme, ***pepsin***, which initiate the chemical digestion of protein. Muscular contractions, called peristalsis, also aid in digestion. The powerful stomach contractions churn the partially digested protein into a more uniform mixture, which is called chyme.



Because of the hydrochloric acid in the stomach, it has a very low pH. **The acidity of the stomach causes food proteins to denature, unfolding their three-dimensional structure** to reveal just the polypeptide chain. This is the first step of chemical digestion of proteins. Recall that the three-dimensional structure of a protein is essential to its function, so **denaturation in the stomach also destroys protein function**. (This is why a protein such as insulin can't be taken as an oral medication. Its function is destroyed in the digestive tract, first by denaturation and then further by enzymatic digestion. Instead, it has to be injected so that it is absorbed intact into the bloodstream.)



Once proteins are denatured in the stomach, the peptide bonds linking amino acids together are more accessible for enzymatic digestion. That process is started by ***pepsin***, an enzyme that is secreted by the cells that line the stomach and is activated by hydrochloric acid. Pepsin begins breaking peptide bonds, creating shorter polypeptides.



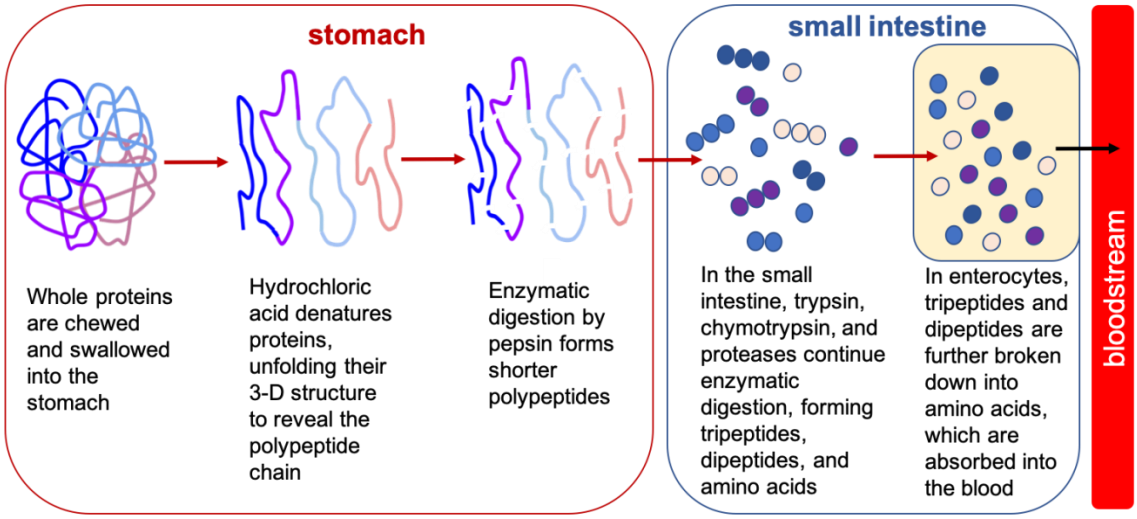
Proteins are large globular molecules, and their chemical breakdown requires time and mixing. Protein digestion in the stomach takes a longer time than carbohydrate digestion, but a shorter time than fat digestion. Eating a high-protein meal increases the amount of time required to sufficiently break down the meal in the stomach. Food remains in the stomach longer, making you feel full longer.

3 – PROTEIN DIGESTION AND ABSORPTION IN THE SMALL INTESTINE

The chyme leaves the stomach and enters the small intestine, where the majority of protein digestion occurs. The pancreas secretes digestive juices into the small intestine, and these contain more enzymes to further break down polypeptides.

The two major pancreatic enzymes that digest proteins in the small intestine are ***chymotrypsin*** and ***trypsin***. Trypsin activates other protein-digesting enzymes called ***proteases***, and together, **these enzymes break proteins down to tripeptides, dipeptides, and individual amino acids.** The cells that line the small intestine release additional enzymes that also contribute to the enzymatic digestion of polypeptides.

Tripeptides, dipeptides, and single amino acids enter the enterocytes of the small intestine using active transport systems, which require ATP. **Once inside, the tripeptides and dipeptides are all broken down to single amino acids, which are absorbed into the bloodstream.** There are several different types of transport systems to accommodate different types of amino acids. Amino acids with structural similarities end up competing to use these transporters. That's not a problem if your protein is coming from food, because it naturally contains a mix of amino acids. However, if you take high doses of amino acid supplements, those could theoretically interfere with absorption of other amino acids.



Proteins that aren't fully digested in the small intestine pass into the large intestine and are eventually excreted in the feces.

WHAT HAPPENS TO ABSORBED AMINO ACIDS?

Once the amino acids are in the blood, they are transported to the liver. As with other macronutrients, the liver is the checkpoint for amino acid distribution and any further breakdown of amino acids, which is very minimal. Dietary amino acids then become part of the body's amino acid pool.

Assuming the body has enough glucose and other sources of energy, those amino acids will be used in one of the following ways:

- Protein synthesis in cells around the body
- Making nonessential amino acids needed for protein synthesis
- Making other nitrogen-containing compounds
- Rearranged and stored as fat (there is no storage form of protein)

If there is not enough glucose or energy available, amino acids can also be used in one of these ways:

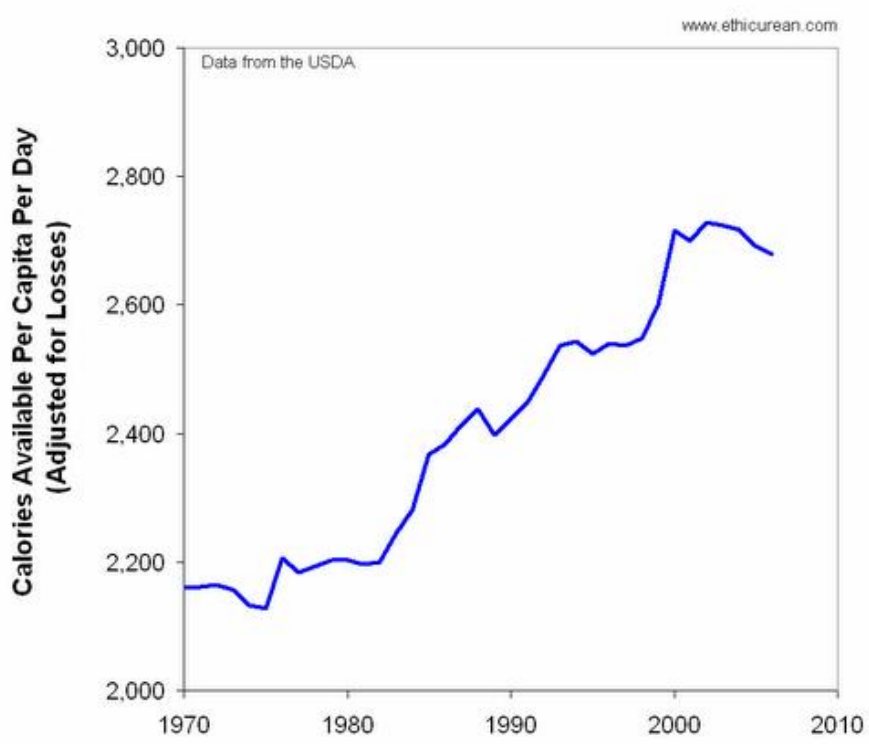
- Rearranged into glucose for fuel for the brain and red blood cells
- Metabolized as fuel, for an immediate source of ATP

In order to use amino acids to make ATP, glucose, or fat, the nitrogen first has to be removed in a process called ***deamination***, which occurs in the liver and kidneys. The nitrogen is initially released as ammonia, and because ammonia is toxic, the liver transforms it into urea. Urea is then transported to the kidneys and excreted in the urine. Urea is a molecule that contains two nitrogens and is highly soluble in water. This makes it ideal for transporting excess nitrogen out of the body.

Because amino acids are building blocks that the body reserves in order to synthesize other proteins, more than 90 percent of the protein ingested does not get broken down further than the amino acid monomers.

Energy Balance

"Energy balance" is the relationship between "energy in" (food calories taken into the body through food and drink) and "energy out" (calories being used in the body for our daily energy requirements).This relationship, which is defined by the laws of thermodynamics, dictates whether weight is lost, gained, or remains the same.
According to these laws, energy is never really created and it's never really destroyed. Rather, energy is transferred between entities.We convert potential energy that's stored within our food (measured in Calories or kcals) into three major "destinations": work, heat and storage.As the image below shows, the average number of available calories per person in the US is increasing. In general, there is more "energy in".



When it comes to "energy out," the body's energy needs include the amount of energy required for maintenance at rest, physical activity and movement, and for food digestion, absorption, and transport.
We can estimate our energy needs by measuring the amount of oxygen we consume. We eat, we digest, we absorb, we circulate, we store, we transfer energy, we burn the energy, and then we repeat.

Energy balance is so important

There's a lot more to energy balance than a change in body weight.Energy balance also has to do with what's going on in your cells. When you're in a positive energy balance (more in than out)

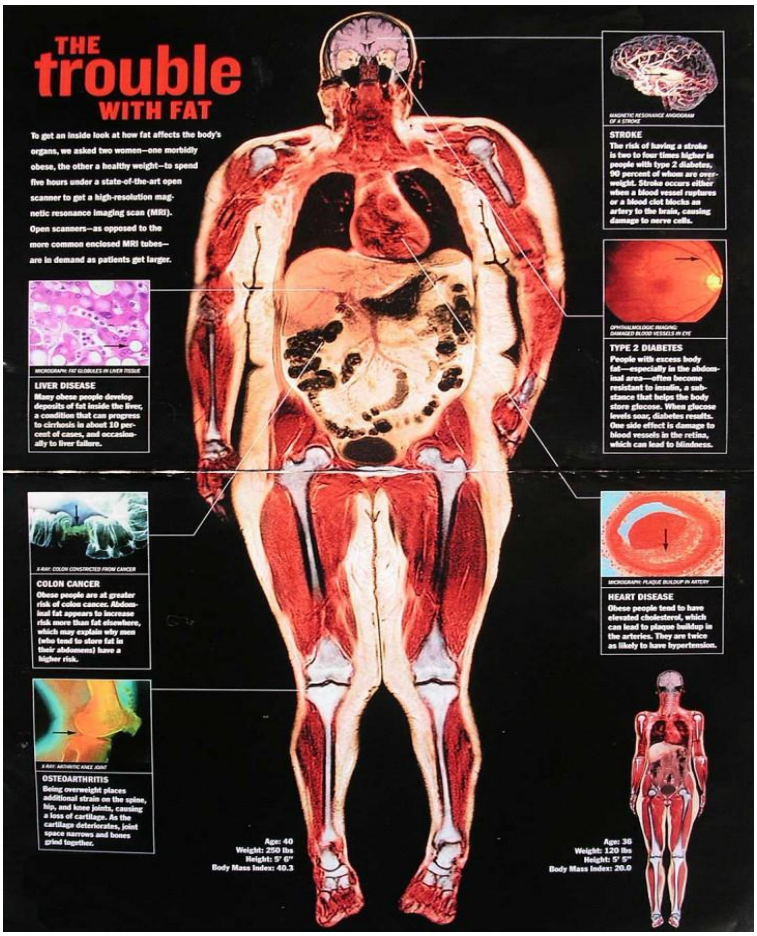
and when you're in a negative energy balance (more out than in), everything from your metabolism, to your hormonal balance, to your mood is impacted.

Negative energy balance

A severe negative energy balance can lead to a decline in metabolism, decreases in bone mass, reductions in thyroid hormones, reductions in testosterone levels, an inability to concentrate, and a reduction in physical performance.Yet a negative energy balance does lead to weight loss. The body detects an energy "deficit" and fat reserves are called upon to make up the difference.

Positive energy balance

Overfeeding (and/or under exercising) has its own ramifications not only in terms of weight gain but in terms of health and cellular fitness.With too much overfeeding, plaques can build up in arteries, the blood pressure and cholesterol in our body can increase, we can become insulin resistant and suffer from diabetes, we can increase our risk for certain cancers, and so on.The relationship between the amount of Calories we eat in the diet and the amount of energy we use in the body determines our body weight and overall health.The body is highly adaptable to a variety of energy intakes/outputs. It must be adaptable in order to survive. Therefore, mechanisms are in place to ensure stable energy transfer regardless of whether energy imbalances exist.



The trouble with long-term positive energy balance

The calorie restriction or over-consumption without a "metabolic intervention" (such as exercise or drugs) is likely to produce equal losses in lean mass and fat mass with restriction or equal gains in lean mass and fat mass with overfeeding.
People will likely end up as smaller or larger versions of the same shape. They'll lose muscle along with fat.Both sides of the energy balance equation are complex and the interrelationships determine body composition and health outcomes.
Gone are the days of eating a 1500 calorie meal from McDonald's and then "exercising" it off. Overall lifestyle habits help to properly control energy balance, and when properly controlled, excessive swings in either direction (positive or negative) are prevented and the body can either lose fat or gain lean mass in a healthy way.

Factors that affect energy in

- Calorie intake
- Energy digested and absorbed (90-99%)

Factors that affect energy out

Work

- Physical work (exercise and activity)

Heat

- Heat produced with physical work
- Heat produced via the thermic effect of food (TEF)
- Heat produced by resting metabolism
- Heat produced: adipose creation
- Heat produced: adipose thermoregulation

Storage

- Efficiency of work
- Efficiency of food metabolism
- Energy stored in adipose tissue

Why do people struggle to get negative or positive?
First and foremost, it's uncomfortable.But furthermore, an interesting phenomenon has developed over the past 25 years.With our focus on specific nutrients, intense dietary counseling, repeated dieting and processed food consumption, body fat levels have also increased. While nutrition and health experts simply blame weight gain on calories, that doesn't paint the whole picture.
Blaming weight gain on calories is like blaming wars on guns. The calories from food are not the sole cause of a skewed energy balance. It's the entire lifestyle and environment.While this may seem illogical, it demonstrates the importance of body awareness (hunger/satiety), avoidance of processed foods, regular physical activity and the persuasion of advertising.

Is calorie counting the solution? Probably not
Many people feel that if they just can add up calorie totals for the day, their energy imbalance problems will be solved.While it can work for some and even make others feel proud of their spreadsheet skills, by the time we add up calories for the day and factor in visual error, variations

in soil quality, variations in growing methods, changes in packaging, and assimilation by the body.

Our energy balance is regulated and monitored by a rich network of systems.

There's a complex interplay between the hypothalamus, neural connections in the body and hormone receptors. Information is received about energy repletion/depletion, the diurnal clock, physical activity level, reproductive cycle, developmental state, and acute and chronic stressors. Moreover, information about the acquisition, storage, and retrieval of sensory and internal food experiences are relayed. These signals can impact energy balance. Even the best spreadsheet skills will have trouble tracking that.

As a society, the more we focus on calories and dietary restraint, the more positive our energy balance seems to get.So, what should we focus on?How about considering ingredients rather than nutrition facts labels?

The nutrition facts label is pretty worthless until we know what we're eating. 100 calories isn't cool when it's Chips Ahoy. So, if monitoring is your thing, then monitor food quality more that quantity.

Straight up overeating

Don't kid yourself: it's still possible to overeat "quality" food. However, this overeating takes place usually when we're "sneaking" calories in by choosing high calorie density foods.

- For example, by using 2 tbsp of olive oil to prepare our meals 3x per day, we can "sneak in" over 90g of fat and 810 calories into our diets. Olive oil is good for us. But adding 810 calories per day probably isn't.
- Further, if we eat 4 handfuls of mixed nuts per day, which may be an extra 300-500 calories, depending on the size of your hands. Again, raw nuts are awesome for us. However, eating too many isn't.
- If we go with 4 whole eggs for breakfast, instead of 3 egg whites and 1 whole egg, that's an extra 18g of fat and 162 calories.
- If we choose lean protein vs. extra lean, we may add an additional few hundred calories of fat to our menu each day without even knowing it.

As you can see from the above, in most cases, we wouldn't really be able to tell the difference between our meals with and without the olive oil, with extra lean vs. lean, and so on.

In essence, we're sneaking the extra calories in without being any more full, and/or without changing anything else about our day. And that's when it's possible to over-eat on nutritious foods.

So, although we discourage counting calories, grams, etc. we do suggest watching out for calorie sneaking.

Apples
385 grams = 200 calories

Fried Bacon
34 grams = 200 calories

Kiwi Fruit
328 grams = 200 calories

Butter
28 grams = 200 calories

All of these plates contain 200 calories

How to be negative or positive
While necessary for fat loss, a negative energy balance can be uncomfortable. Being in a negative energy state can result in hunger, agitation, and even slight sleep problems.On the flip side, while necessary for muscle gain, a positive energy balance can be uncomfortable as well. Both extremes cause the body to get out of, well, balance.

Accomplishing a negative energy balance can be done in different ways.
Increasing the amount of weekly physical activity you participate in is one of the best options.

How to create a negative energy balance

- Build muscle with weight training (about 5 hours of total exercise each week) and proper nutrition
- Create muscle damage with intense weight training
- Maximize post workout energy expenditure by using high intensity exercise
- Regular program change to force new stimuli and adaptations
- Boost non-exercise physical activity
- Increase thermic effect of feeding by increasing unprocessed food intake
- Eat at regular intervals throughout the day
- Eat lean protein at regular intervals throughout the day
- Eat vegetables and/or fruit at regular intervals
- Incorporate omega-3 fats
- Incorporate multiple exercise modes
- Stay involved with “life” outside of exercise and nutrition
- Sleep 7-9 hours each night
- Don’t engage in extreme diets for risk of long-term overcompensation
- Stay consistent with habits
- Ignore food advertising

How to create a positive energy balance

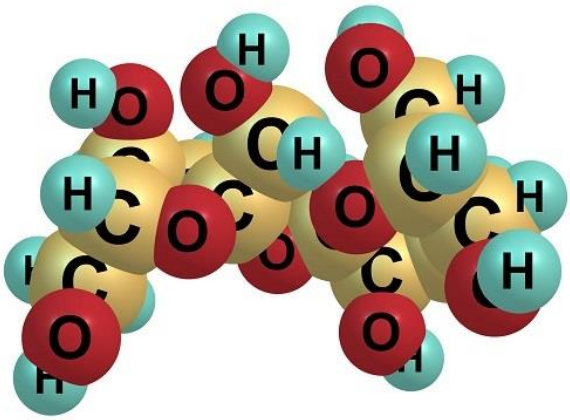
- Build muscle with weight training (at least 4 hours of intense exercise per week) and proper nutrition
- Create muscle damage with intense weight training
- Minimize other forms of exercise (other than high intensity and resistance training)
- Limit excessive non-exercise physical activity
- Try consuming more shakes and liquids with calories
- Build in energy dense foods that don't cause rapid satiety (nut butters, nuts, trail mix, oils, etc.)
- Eat at regular intervals throughout the day
- Incorporate additional omega-3 fats
- Take advantage of peri-workout nutrition, with plenty of nutrients consumed before, during, and after exercise
- Sleep 7-9 hours per night
- Stay consistent with habits

Micronutrients act as cofactors and/or coenzymes in the liberation of energy from food. A limited intake can disturb energy balance and can lead to numerous side effects.
Some factors that have been associated with attaining a negative energy balance include:

- Regular nut consumption
- Meal replacement supplements/super shakes
- Green tea
- Low energy density foods (veggies, fruits, lean proteins, whole grains, etc.)
- Dietary protein
- Avoidance of refined carbohydrates
- Adequate hydration
- Dietary fiber
- Fruits
- Vegetables
- Regular exercise
- Adequate sleep
- Positive social support

Carbohydrates

- Consisting of oxygen (O), carbon (C), and hydrogen (H), carbohydrate is a biological molecule.
- Carbohydrate is one of the essential elements for the living organisms, as it plays various important roles.



- Carbohydrate is the main source of energy, as about two-third energy requirement of living beings is fulfilled by it.
- Glucose, sugar, and starch are the important examples of carbohydrate.

Source of Carbohydrate

- Carbohydrates naturally are occurring in wide variety of foods, such as −
  - **Wheat**
  - **Maize**
  - **Rice**
  - **Potatoes**
  - **Sugarcane**
  - **Fruits**
  - **Table sugar**
  - **Bread**
  - **Milk**
- Sugar that we eat in our everyday life is mainly sucrose (table sugar).
- Sucrose is added in many food items while preparing, e.g. jam, biscuits, cakes, energy drinks, etc.
- Further, many fruits naturally contain glucose and fructose.
- Glycogen is another type of carbohydrate that found in the liver and muscle.
- Cellulose found in the cell wall of plant cells is carbohydrate.

Types of Carbohydrate

- The following table illustrates major categories and sub-categories of carbohydrate −

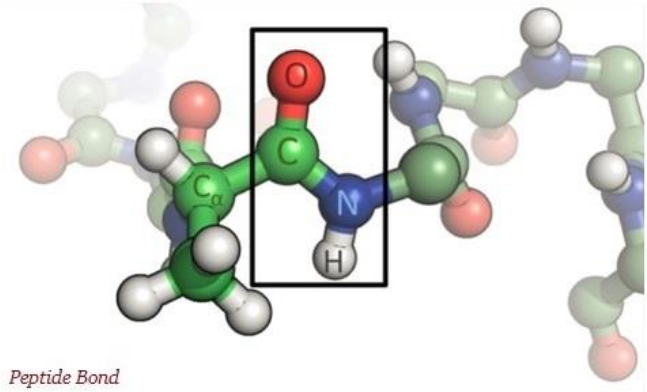
Class	Subgroup	Components
Sugar	Monosaccharides	Glucose, fructose, xylose, galactose
	Disaccharides	Sucrose, lactose, maltose, trehalose
	Polyols	Sorbitol, mannitol
Oligosaccharides	Malto-oligosaccharides	Maltodextrins
	Other oligosaccharides	Raffinose, stachyose, fructo-oligosaccharides
Polysaccharides	Starch	Amylose, amylopectin, modified starches
	Non-starch polysaccharides	Cellulose, hemicellulose, pectins, hydrocolloids

Functions of Carbohydrate

- Following are the major functions of carbohydrates −
    - Carbohydrates provide energy required for the proper function of the body.
    - Carbohydrates also store food in the body for the contingency period.
    - Carbohydrates form nucleic acids.
    - Carbohydrates also support skeleton system of animals.
    - Carbohydrates provide sweetness and flavor.
    - Carbohydrates break down the fatty acid.

Proteins

- Proteins, which are basically biomolecules, play wide range of functions in the body of a living organism.
- Proteins are made up of tiny elements of different types of amino acids.
- A sequence of amino acid residues in a protein is known particularly by the sequence of a gene; gene is encoded in the genetic code.
- After formation, proteins exist for a fixed period of time and are then degraded and recycled.
- The proteins get recycled by the cell's machinery by the process of protein turnover.
- Most of the proteins contain linear polymers made up of series of up to 20 different L-α-amino acids.
- The amino acids in a polypeptide chain are connected by peptide bonds (see the image given below).

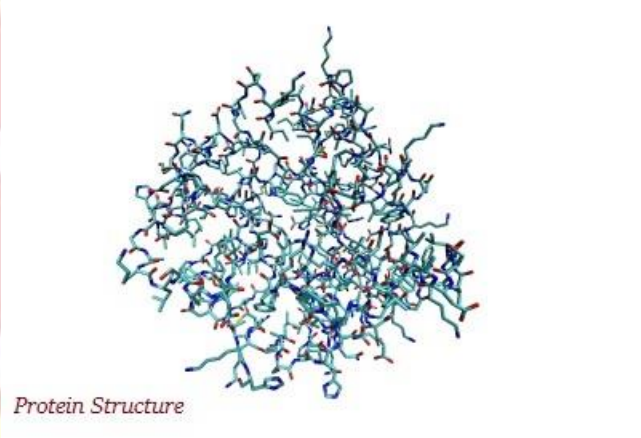


Peptide Bond

- The peptide bond, usually, has two resonance forms, which contribute some double-bond characters.

Protein Structure

- Most of the proteins illustrate unique 3-dimensional structures (see image given below).



Protein Structure

- However, proteins have not a rigid structure, but rather, proteins may vary between several related structures especially when they perform their functions.

Functions of Proteins

- Following are the major functions of proteins −
    - In the cell, proteins are the chief actors that carry out the duties defined by the information encoded in genes.
    - Proteins are essential for the overall body growth.
    - Proteins play a role of bio-catalyst and biotic regulator.
    - Proteins provide instant energy especially during the emergency period.
    - Proteins help in catalyzing the metabolic reactions.
    - Proteins are the essential elements in DNA replication.

- Proteins actively help in transporting molecules from one location to another in the body.

Types of Protein

- Following are the major types of protein −
  - **Enzymes** − enzymes play important role especially during the breakdown of molecules. Enzymes are also required for the digestion and growth of the cell.
  - **Structural Proteins** − such type of proteins provide strength to cells, tissues, and organs.
  - **Signaling Proteins** − Such proteins facilitate cells to communicate with each other by providing signals.
  - **Defensive Proteins** − Such proteins help organisms to fight with infection and support damaged tissue in healing fast.
  - **Hormone** − Some hormones are proteins that help in metabolic activities.

Vitamins

- Vitamin is one of the most essential organic compounds that organisms require for the growth and maintenance of the body.
- Unlike other nutrients, vitamins are classified by their biological and chemical activity, instead of their structure.

- The term vitamin was derived from a compound word namely "vitamin."
- The Polish biochemist Kazimierz Funk, first used the compound word ‘vitamin’ in 1912.
- Usually, vitamins are represented by the English capital letters, e.g. A, B, C, E, etc.
- The body of a human being stores different vitamins widely; the vitamins A, D, and B12 are stored in substantial amounts, generally in the liver.
- Deficiency of vitamins causes disease.
- Based on solubility, vitamins are classified as water soluble vitamins and fat soluble vitamins.

- Water-soluble vitamins can dissolve easily in water.
- On the other hand, fat-soluble vitamins can be dissolved easily in fat.
- Further, fat-soluble vitamins get absorbed easily through the intestinal tract.

List of Vitamins

- By the time, thirteen vitamins are comprehensively recognized.
- The following table illustrates the list of vitamins with their properties −

Vitamins	Chemical Name	Solubility	Deficiency disease
Vitamin A	Retinol	Fat	Night blindness, keratomalacia, etc.
Vitamin B1	Thiamine	Water	Beriberi
Vitamin B2	Riboflavin	Water	Ariboflavinosis, glossitis, etc.
Vitamin B3	Niacin	Water	Pellagra
Vitamin B5	Pantothenic acid	Water	Paresthesia
Vitamin B6	Pyridoxine	Water	Anemia
Vitamin B7	Biotin	Water	Dermatitis
Vitamin B9	Folic acid	Water	Megaloblastic anemia
Vitamin B12	Cyanocobalamin	Water	Pernicious anemia
Vitamin C	Ascorbic acid	Water	Scurvy
Vitamin D	Cholecalciferol	Fat	Rickets
Vitamin E	Tocopherols	Fat	Hemolytic anemia (in children)
Vitamin K	Phylloquinone	Fat	Bleeding diathesis

Functions of Vitamins

- Vitamins have different biochemical functions, significant of them are −
    - Like hormone, vitamin D regulates and helps in mineral metabolism
    - Vitamin D also regulates and helps cells and tissue growth
    - Vitamin C and vitamin E act as antioxidants

- Vitamin B complex acts as co-enzymes or the precursors of enzymes and helps them as catalysts in metabolic activities.

Minerals

- Mineral is a chemical element essentially required as nutrient for the proper functioning of the body and healthy life.
- Minerals cannot be made by living organisms, rather it occurs in the Earth naturally.

- Most of the minerals that required for the proper function of a human life come from green plants, animals, and from drinking water.
- Calcium, phosphorus, potassium, sodium, and magnesium are the five major minerals in the human body.
- Minerals are present in the blood of a healthy human being at certain mass.

Major Minerals

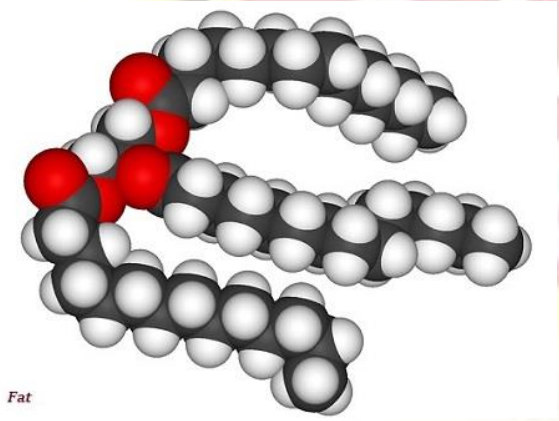
- The following table illustrates the list of major minerals along with their salient features –

Minerals	**Deficiency disease**	**Sources**
Potassium	Hypokalemia	Sweet potato, potato, tomato, lentils, banana, carrot, orange, etc.
Chlorine	Hypochloremia	Table salt
Sodium	Hyponatremia	Table salt, sea vegetable, milk, etc.
Calcium	Hypocalcaemia	Eggs, canned fish, dairy products, nuts, etc.
Phosphorus	Hypophosphatemia	Red meat, fish, bread, dairy products, rice, oats, etc.
Magnesium	Hypomagnesemia	Legumes, nuts, seeds, spinach, peanut butter, etc.

Iron	Anaemia	Meat, seafood, beans, nuts, etc.
Zinc	Hair loss, diarrhea	Red meat, nuts, dairy products, etc.
Manganese	Osteoporosis	Grains, nuts, leafy vegetables, legumes, seeds, tea, coffee
Copper	Copper deficiency	Seafood, oysters, nuts, seeds
Iodine	Goitre	Grains, eggs, iodized salt
Chromium	Chromium deficiency	Broccoli, grape juice, meat, etc.
Molybdenum	Molybdenum deficiency	Legumes, whole grains, nuts
Selenium	Selenium deficiency	Brazil nuts, meat, seafoods, grains, dairy products, etc.

Fats

- Fat is a significant foodstuff for many forms of life.
- Fats serve structural as well as metabolic functions.
- The fats are molecules made up of glycerol and fatty acid.
- Fat is an organic compound of hydrogen, carbon, oxygen.
- Based on the number and bonding of the carbon atoms, fats and oils, are categorized in the aliphatic chain.



Fat

Functions of Fats

- Following are the major functions of Fats −
    - Fat is a vital dietary requirement.
    - The fat is usually the stored source of energy in the body that remained store beneath the skin.
    - Fat acts a protective layer especially in the human body and provide protection.

- Some of the vitamins such as vitamin A, vitamin D, vitamin E, and vitamin K are fat-soluble, which means they can only be absorbed, digested, and transported in conjunction with the fats.
- Fats actively help in maintaining the healthy skin and hair.
- Fats insulate body organs against external shock.
- Fats also maintain body temperature.
- Fats promote healthy cell function.

Types of Fats

- Following are the major types of Fats −

Unsaturated Fats

- The fats that remain in the liquid form at room temperature are known as unsaturated fats.
- Unsaturated fats are beneficial for health, as it improves blood cholesterol levels, stabilize heart beats, etc.
- Unsaturated fats are commonly found in vegetable oils, nuts, and many seeds.

Saturated Fats

- Saturated fats have no double bonds between the carbons found in its chain.
- Saturated fats can easily solidify and typically found in solid form at room temperature.
- Saturated fats are found in animals' meat, cheese, ice cream, etc.

Obesity

Body mass index (BMI) is a calculation that takes a person's weight and height into account to measure body size.

In adults, obesity is defined as having a BMI of 30.0 or more, according to the Centers for Disease Control and Prevention (CDC).

Obesity is associated with a higher risk for serious diseases, such as type 2 diabetes, heart disease, and cancer.

Obesity is common. The CDC estimates that 42.4 percent Trusted Source of Americans 20 years old and older had obesity in 2017 to 2018.

But BMI isn't everything. It has some limitations as a metric.

According to the CDCTrusted Source: "Factors such as age, sex, ethnicity, and muscle mass can influence the relationship between BMI and body fat. Also, BMI doesn't distinguish between

excess fat, muscle, or bone mass, nor does it provide any indication of the distribution of fat among individuals."

Despite these limitations, BMI continues to be widely used as a way to measure body size.

Obesity classification

The following classesTrusted Source are used for adults who are at least 20 years old:

BMI	Class
18.5 or under	underweight
18.5 to <25.0	"normal" weight
25.0 to <30.0	overweight
30.0 to <35.0	class 1 obesity
35.0 to <40.0	class 2 obesity
40.0 or over	class 3 obesity (also known as morbid, extreme, or severe obesity)

Childhood obesity

For a doctor to diagnose a child over 2 years old or a teen with obesity, their BMI has to be in the 95th percentileTrusted Source for people of their same age and biological sex:

Percentile range of BMI	Class
>5%	underweight
5% to <85%	"normal" weight
85% to <95%	overweight
95% or over	obesity

Causes of obesity

Eating more calories than you burn in daily activity and exercise — on a long-term basis — can lead to obesity. Over time, these extra calories add up and cause weight gain.But it's not always just about calories in and calories out, or having a sedentary lifestyle. While those are indeed causes of obesity, some causes you can't control.

Common specific causes of obesity include:

- genetics, which can affect how your body processes food into energy and how fat is stored
- growing older, which can lead to less muscle mass and a slower metabolic rate, making it easier to gain weight
- not sleeping enough, which can lead to hormonal changes that make you feel hungrier and crave certain high-calorie foods
- pregnancy, as weight gained during pregnancy may be difficult to lose and might eventually lead to obesity

Certain health conditions can also lead to weight gain, which may lead to obesity. These include:

- polycystic ovary syndrome (PCOS), a condition that causes an imbalance of female reproductive hormones
- Prader-Willi syndrome, a rare condition present at birth that causes excessive hunger
- Cushing syndrome, a condition caused by having high cortisol levels (the stress hormone) in your system
- hypothyroidism (underactive thyroid), a condition in which the thyroid gland doesn't produce enough of certain important hormones
- osteoarthritis (OA) and other conditions that cause pain that may lead to reduced activity

Risk for obesity

A complex mix of factors can increase a person's risk for obesity.

Genetics

Some people have genes that make it difficult for them to lose weight.

Environment and community

Your environment at home, at school, and in your community can all influence how and what you eat, and how active you are.

You may be at a higher risk for obesity if you:

- live in a neighborhood with limited healthy food options or with manyTrusted Source high-calorie food options, like fast-food restaurants
- haven't yet learned to cook healthy meals
- don't think you can afford healthier foods
- haven't foundTrusted Source a good place to play, walk, or exercise in your neighborhood

Psychological and other factors

Depression can sometimes lead to weight gain, as some people may turn to food for emotional comfort. Certain antidepressants can also increase the risk of weight gain.

Quitting smoking is always a good thing, but quitting may lead to weight gain too. In some people, it may lead to excessiveTrusted Source weight gain. For that reason, it's important to focus on diet and exercise while you're quitting, at least after the initial withdrawal period.

Medications, such as steroids or birth control pills, can also raise your risk for weight gain.

Obesity can be diagnosed

BMI is a rough calculation of a person's weight in relation to their height.

Other more accurate measures of body fat and body fat distribution include:

- skinfold thickness tests
- waist-to-hip comparisons
- screening tests, such as ultrasounds, CT scans, and MRI scans

Your doctor may also order certain tests to help diagnose obesity-related health risks. These may include:

- blood tests to examine cholesterol and glucose levels
- liver function tests
- a diabetes screening
- thyroid tests

- heart tests, such as an electrocardiogram (ECG or EKG)

A measurement of the fat around your waist is also a good predictor of your risk for obesity-related diseases.

Complications of obesity

Obesity can lead to more than simple weight gain.

Having a high ratio of body fat to muscle puts strain on your bones as well as your internal organs. It also increases inflammation in the body, which is thought to be a risk factor for cancer. Obesity is also a major risk factor for type 2 diabetes.

Obesity has been linked to a number of health complications, some of which can be life threatening if not treated:

- type 2 diabetes
- heart disease
- high blood pressure
- certain cancers (breast, colon, and endometrial)
- stroke
- gallbladder disease
- fatty liver disease
- high cholesterol
- sleep apnea and other breathing problems
- arthritis
- infertility

Obesity treatment

If you have obesity and been unable to lose weight on your own, medical help is available. Start with your primary care physician, who may be able to refer you to a weight specialist in your area.

Your doctor may also want to work with you as part of a team helping you lose weight. That team might include a dietitian, therapist, or other healthcare staff.

Your doctor will work with you on making needed lifestyle changes. Sometimes, they may recommend medications or weight loss surgery as well. Learn more about treatment for obesity.

Lifestyle and behavioral changes can help for weight loss

Your healthcare team can educate you on food choices and help develop a healthy eating plan that works for you.

A structured exercise program and increased daily activity — up to 300 minutes a week — will help build up your strength, endurance, and metabolism.

Counseling or support groups may also identify unhealthy triggers and help you cope with any anxiety, depression, or emotional eating issues.

Lifestyle and behavioral changes are the preferred weight loss methods for children, unless they're extremely overweight.

Medications prescribed for weight loss

Your doctor may also prescribe certain prescription weight loss medications in addition to eating and exercise plans.

Medications are usually prescribed only if other methods of weight loss haven't worked and if you have a BMI of 27.0 or more in addition to obesity-related health issues.

Prescription weight loss medications either prevent the absorption of fat or suppress appetite. The following are approved for long-term use (at least 12 weeks) by the Food and Drug Administration (FDA):

- phentermine/topiramate (Qsymia)
- naltrexone/bupropion (Contrave)
- liraglutide (Saxenda)
- orlistat (Alli, Xenical), the only one that's FDA-approved for use in children 12 years old and older

These drugs can have unpleasant side effects. For example, orlistat can lead to oily and frequent bowel movements, bowel urgency, and gas.

Your doctor will monitor you closely while you're taking these medications.

Types of weight loss surgery

Weight loss surgery is commonly called bariatric surgery.

This type of surgery works by limiting how much food you can comfortably eat or by preventing your body from absorbing food and calories. Sometimes it can do both.

Weight loss surgery isn't a quick fix. It's a major surgery and can have serious risks. Afterward, people who undergo surgery will need to change how they eat and how much they eat, or they risk getting sick.

However, nonsurgical options aren't always effective at helping people with obesity lose weight and reduce their risk for comorbidities.

Types of weight loss surgery include:

- **Gastric bypass surgery.** In this procedure, your surgeon creates a small pouch at the top of your stomach that connects directly to your small intestine. Food and liquids go through the pouch and into the intestine, bypassing most of the stomach. It's also known as Roux-en-Y gastric bypass (RYGB) surgery.
- **Laparoscopic adjustable gastric banding (LAGB).** LAGB separates your stomach into two pouches using a band.
- **Gastric sleeve surgery.** This procedure removes part of your stomach.
- **Biliopancreatic diversion with duodenal switch.** This procedure removes most of your stomach.

Candidates for surgery

For decades, experts recommended that adult candidates for weight loss surgery have a BMI of at least 35.0 (classes 2 and 3).

However, in 2018 guidelines, the American Society for Metabolic and Bariatric Surgery (ASMBS) endorsed weight loss surgery for adults with BMIs of 30.0 up to 35.0 (class 1) who:

- have related comorbidities, especially type 2 diabetes
- haven't seen sustained results from nonsurgical treatments, such as eating and lifestyle modifications

For individuals with class 1 obesity, surgery is most effective for those between the ages of 18 and 65 years old.

People will often have to lose some weight before undergoing surgery. Additionally, they'll normally undergo counseling to ensure that they're both emotionally prepared for the surgery and willing to make the necessary lifestyle changes that it'll require.

Only a few surgical centers in the United States perform these types of procedures on children under 18 years old.

Preventionfor obesity

There's been a dramatic increase in obesity and in obesity-related diseases in the last couple decades. This is the reason why communities, states, and the federal government are putting an emphasis on healthier food choices and activities to help turn the tide on obesity.

On a personal level, you can help prevent weight gain and obesity by making healthier lifestyle choices:

- Aim for moderate exercise like walking, swimming, or biking for 20 to 30 minutes every day.
- Eat well by choosing nutritious foods, like fruits, vegetables, whole grains, and lean protein.
- Eat high-fat, high-calorie foods in moderation.

Diabetes

Diabetes mellitus refers to a group of diseases that affect how your body uses blood sugar (glucose). Glucose is vital to your health because it's an important source of energy for the cells that make up your muscles and tissues. It's also your brain's main source of fuel.

The underlying cause of diabetes varies by type. But, no matter what type of diabetes you have, it can lead to excess sugar in your blood. Too much sugar in your blood can lead to serious health problems.

Chronic diabetes conditions include type 1 diabetes and type 2 diabetes. Potentially reversible diabetes conditions include prediabetes and gestational diabetes. Prediabetes occurs when your blood sugar levels are higher than normal, but not high enough to be classified as diabetes. And prediabetes is often the precursor of diabetes unless appropriate measures are taken to prevent progression. Gestational diabetes occurs during pregnancy but may resolve after the baby is delivered.

Symptoms

Diabetes symptoms vary depending on how much your blood sugar is elevated. Some people, especially those with prediabetes or type 2 diabetes, may sometimes not experience symptoms. In type 1 diabetes, symptoms tend to come on quickly and be more severe.

Some of the signs and symptoms of type 1 diabetes and type 2 diabetes are:

- Increased thirst
- Frequent urination
- Extreme hunger
- Unexplained weight loss
- Presence of ketones in the urine (ketones are a byproduct of the breakdown of muscle and fat that happens when there's not enough available insulin)
- Fatigue
- Irritability
- Blurred vision
- Slow-healing sores
- Frequent infections, such as gums or skin infections and vaginal infections

Type 1 diabetes can develop at any age, though it often appears during childhood or adolescence. Type 2 diabetes, the more common type, can develop at any age, though it's more common in people older than 40.

- **If you suspect you or your child may have diabetes.** If you notice any possible diabetes symptoms, contact your doctor. The earlier the condition is diagnosed, the sooner treatment can begin.
- **If you've already been diagnosed with diabetes.** After you receive your diagnosis, you'll need close medical follow-up until your blood sugar levels stabilize.

Causes

To understand diabetes, first you must understand how glucose is normally processed in the body.

Insulin is a hormone that comes from a gland situated behind and below the stomach (pancreas).

- The pancreas secretes insulin into the bloodstream.
- The insulin circulates, enabling sugar to enter your cells.
- Insulin lowers the amount of sugar in your bloodstream.
- As your blood sugar level drops, so does the secretion of insulin from your pancreas.

Role of glucose

Glucose — a sugar — is a source of energy for the cells that make up muscles and other tissues.

- Glucose comes from two major sources: food and your liver.
- Sugar is absorbed into the bloodstream, where it enters cells with the help of insulin.
- Your liver stores and makes glucose.
- When your glucose levels are low, such as when you haven't eaten in a while, the liver breaks down stored glycogen into glucose to keep your glucose level within a normal range.

Causes of type 1 diabetes

The exact cause of type 1 diabetes is unknown. What is known is that your immune system — which normally fights harmful bacteria or viruses — attacks and destroys your insulin-producing cells in the pancreas. This leaves you with little or no insulin. Instead of being transported into your cells, sugar builds up in your bloodstream.

Type 1 is thought to be caused by a combination of genetic susceptibility and environmental factors, though exactly what those factors are is still unclear. Weight is not believed to be a factor in type 1 diabetes.

Causes of prediabetes and type 2 diabetes

In prediabetes — which can lead to type 2 diabetes — and in type 2 diabetes, your cells become resistant to the action of insulin, and your pancreas is unable to make enough insulin to overcome this resistance. Instead of moving into your cells where it's needed for energy, sugar builds up in your bloodstream.

Exactly why this happens is uncertain, although it's believed that genetic and environmental factors play a role in the development of type 2 diabetes too. Being overweight is strongly linked to the development of type 2 diabetes, but not everyone with type 2 is overweight.

Causes of gestational diabetes

During pregnancy, the placenta produces hormones to sustain your pregnancy. These hormones make your cells more resistant to insulin.

Normally, your pancreas responds by producing enough extra insulin to overcome this resistance. But sometimes your pancreas can't keep up. When this happens, too little glucose gets into your cells and too much stays in your blood, resulting in gestational diabetes.

Risk factors

Risk factors for diabetes depend on the type of diabetes.

Risk factors for type 1 diabetes

Although the exact cause of type 1 diabetes is unknown, factors that may signal an increased risk include:

- **Family history.** Your risk increases if a parent or sibling has type 1 diabetes.
- **Environmental factors.** Circumstances such as exposure to a viral illness likely play some role in type 1 diabetes.
- **The presence of damaging immune system cells (autoantibodies).** Sometimes family members of people with type 1 diabetes are tested for the presence of diabetes autoantibodies. If you have these autoantibodies, you have an increased risk of developing type 1 diabetes. But not everyone who has these autoantibodies develops diabetes.
- **Geography.** Certain countries, such as Finland and Sweden, have higher rates of type 1 diabetes.

Risk factors for prediabetes and type 2 diabetes

Researchers don't fully understand why some people develop prediabetes and type 2 diabetes and others don't. It's clear that certain factors increase the risk, however, including:

- **Weight.** The more fatty tissue you have, the more resistant your cells become to insulin.
- **Inactivity.** The less active you are, the greater your risk. Physical activity helps you control your weight, uses up glucose as energy and makes your cells more sensitive to insulin.
- **Family history.** Your risk increases if a parent or sibling has type 2 diabetes.
- **Race or ethnicity.** Although it's unclear why, certain people — including Black, Hispanic, American Indian and Asian American people — are at higher risk.
- **Age.** Your risk increases as you get older. This may be because you tend to exercise less, lose muscle mass and gain weight as you age. But type 2 diabetes is also increasing among children, adolescents and younger adults.
- **Gestational diabetes.** If you developed gestational diabetes when you were pregnant, your risk of developing prediabetes and type 2 diabetes increases. If you gave birth to a baby weighing more than 9 pounds (4 kilograms), you're also at risk of type 2 diabetes.

- **Polycystic ovary syndrome.** For women, having polycystic ovary syndrome — a common condition characterized by irregular menstrual periods, excess hair growth and obesity — increases the risk of diabetes.
- **High blood pressure.** Having blood pressure over 140/90 millimeters of mercury (mm Hg) is linked to an increased risk of type 2 diabetes.
- **Abnormal cholesterol and triglyceride levels.** If you have low levels of high-density lipoprotein (HDL), or "good," cholesterol, your risk of type 2 diabetes is higher. Triglycerides are another type of fat carried in the blood. People with high levels of triglycerides have an increased risk of type 2 diabetes. Your doctor can let you know what your cholesterol and triglyceride levels are.

Risk factors for gestational diabetes

Pregnant women can develop gestational diabetes. Some women are at greater risk than are others. Risk factors for gestational diabetes include:

- **Age.** Women older than age 25 are at increased risk.
- **Family or personal history.** Your risk increases if you have prediabetes — a precursor to type 2 diabetes — or if a close family member, such as a parent or sibling, has type 2 diabetes. You're also at greater risk if you had gestational diabetes during a previous pregnancy, if you delivered a very large baby or if you had an unexplained stillbirth.
- **Weight.** Being overweight before pregnancy increases your risk.
- **Race or ethnicity.** For reasons that aren't clear, women who are Black, Hispanic, American Indian or Asian American are more likely to develop gestational diabetes.

Complications

Long-term complications of diabetes develop gradually. The longer you have diabetes — and the less controlled your blood sugar — the higher the risk of complications. Eventually, diabetes complications may be disabling or even life-threatening. Possible complications include:

- **Cardiovascular disease.** Diabetes dramatically increases the risk of various cardiovascular problems, including coronary artery disease with chest pain (angina), heart attack, stroke and narrowing of arteries (atherosclerosis). If you have diabetes, you're more likely to have heart disease or stroke.
- **Nerve damage (neuropathy).** Excess sugar can injure the walls of the tiny blood vessels (capillaries) that nourish your nerves, especially in your legs. This can cause tingling, numbness, burning or pain that usually begins at the tips of the toes or fingers and gradually spreads upward.

  Left untreated, you could lose all sense of feeling in the affected limbs. Damage to the nerves related to digestion can cause problems with nausea, vomiting, diarrhea or constipation. For men, it may lead to erectile dysfunction.
- **Kidney damage (nephropathy).** The kidneys contain millions of tiny blood vessel clusters (glomeruli) that filter waste from your blood. Diabetes can damage this delicate filtering

system. Severe damage can lead to kidney failure or irreversible end-stage kidney disease, which may require dialysis or a kidney transplant.

- **Eye damage (retinopathy).** Diabetes can damage the blood vessels of the retina (diabetic retinopathy), potentially leading to blindness. Diabetes also increases the risk of other serious vision conditions, such as cataracts and glaucoma.
- **Foot damage.** Nerve damage in the feet or poor blood flow to the feet increases the risk of various foot complications. Left untreated, cuts and blisters can develop serious infections, which often heal poorly. These infections may ultimately require toe, foot or leg amputation.
- **Skin conditions.** Diabetes may leave you more susceptible to skin problems, including bacterial and fungal infections.
- **Hearing impairment.** Hearing problems are more common in people with diabetes.
- **Alzheimer's disease.** Type 2 diabetes may increase the risk of dementia, such as Alzheimer's disease. The poorer your blood sugar control, the greater the risk appears to be. Although there are theories as to how these disorders might be connected, none has yet been proved.
- **Depression.** Depression symptoms are common in people with type 1 and type 2 diabetes. Depression can affect diabetes management.

Complications of gestational diabetes

Most women who have gestational diabetes deliver healthy babies. However, untreated or uncontrolled blood sugar levels can cause problems for you and your baby.

Complications in your baby can occur as a result of gestational diabetes, including:

- **Excess growth.** Extra glucose can cross the placenta, which triggers your baby's pancreas to make extra insulin. This can cause your baby to grow too large (macrosomia). Very large babies are more likely to require a C-section birth.
- **Low blood sugar.** Sometimes babies of mothers with gestational diabetes develop low blood sugar (hypoglycemia) shortly after birth because their own insulin production is high. Prompt feedings and sometimes an intravenous glucose solution can return the baby's blood sugar level to normal.
- **Type 2 diabetes later in life.** Babies of mothers who have gestational diabetes have a higher risk of developing obesity and type 2 diabetes later in life.
- **Death.** Untreated gestational diabetes can result in a baby's death either before or shortly after birth.

Complications in the mother also can occur as a result of gestational diabetes, including:

- **Preeclampsia.** This condition is characterized by high blood pressure, excess protein in the urine, and swelling in the legs and feet. Preeclampsia can lead to serious or even life-threatening complications for both mother and baby.

- **Subsequent gestational diabetes.** Once you've had gestational diabetes in one pregnancy, you're more likely to have it again with the next pregnancy. You're also more likely to develop diabetes — typically type 2 diabetes — as you get older.

Complications of prediabetes

Prediabetes may develop into type 2 diabetes.

Prevention

Type 1 diabetes can't be prevented. However, the same healthy lifestyle choices that help treat prediabetes, type 2 diabetes and gestational diabetes can also help prevent them:

- **Eat healthy foods.** Choose foods lower in fat and calories and higher in fiber. Focus on fruits, vegetables and whole grains. Strive for variety to prevent boredom.
- **Get more physical activity.** Aim for about 30 minutes of moderate aerobic activity on most days of the week, or at least 150 minutes of moderate aerobic activity a week.
- **Lose excess pounds.** If you're overweight, losing even 7% of your body weight — for example, 14 pounds (6.4 kilograms) if you weigh 200 pounds (90.7 kilograms) — can reduce the risk of diabetes.

  Don't try to lose weight during pregnancy, however. Talk to your doctor about how much weight is healthy for you to gain during pregnancy.

  To keep your weight in a healthy range, focus on permanent changes to your eating and exercise habits. Motivate yourself by remembering the benefits of losing weight, such as a healthier heart, more energy and improved self-esteem.

Sometimes medication is an option as well. Oral diabetes drugs such as metformin (Glumetza, Fortamet, others) may reduce the risk of type 2 diabetes — but healthy lifestyle choices remain essential. Have your blood sugar checked at least once a year to check that you haven't developed type 2 diabetes.

Cardiovascular Disease

The cardiovascular, or circulatory, system supplies the body with blood. It consists of the heart, arteries, veins, and capillaries.

Types

There are many types of CVD.

CVD comprises many different types of condition. Some of these might develop at the same time or lead to other conditions or diseases within the group.

Diseases and conditions that affect the heart include:

- angina, a type of chest pain that occurs due to decreased blood flow into the heart
- arrhythmia, or an irregular heartbeat or heart rhythm

- congenital heart disease, in which a problem with heart function or structure is present from birth
- coronary artery disease, which affects the arteries that feed the heart muscle
- heart attack, or a sudden blockage to the heart's blood flow and oxygen supply
- heart failure, wherein the heart cannot contract or relax normally
- dilated cardiomyopathy, a type of heart failure, in which the heart gets larger and cannot pump blood efficiently
- hypertrophic cardiomyopathy, in which the heart muscle walls thicken and problems with relaxation of the muscle, blood flow, and electrical instability develop
- mitral regurgitation, in which blood leaks back through the mitral valve of the heart during contractions
- mitral valve prolapse, in which part of the mitral valve bulges into the left atrium of the heart while it contracts, causing mitral regurgitation
- pulmonary stenosis, in which a narrowing of the pulmonary artery reduces blood flow from the right ventricle (pumping chamber to the lungs) to the pulmonary artery (blood vessel that carries deoxygenated blood to the lungs)
- aortic stenosis, a narrowing of the heart valve that can cause blockage to blood flow leaving the heart
- atrial fibrillation, an irregular rhythm that can increase the risk of stroke
- rheumatic heart disease, a complication of strep throat that causes inflammation in the heart and which can affect the function of heart valves
- radiation heart disease, wherein radiation to the chest can lead to damage to the heart valves and blood vessels

Vascular diseases affect the arteries, veins, or capillaries throughout the body and around the heart.

They include:

- peripheral artery disease, which causes arteries to become narrow and reduces blood flow to the limbs
- aneurysm, a bulge or enlargement in an artery that can rupture and bleed
- atherosclerosis, in which plaque forms along the walls of blood vessels, narrowing them and restricting the flow of oxygen rich blood
- renal artery disease, which affects the flow of blood to and from the kidneys and can lead to high blood pressure

- Raynaud's disease, which causes arteries to spasm and temporarily restrict blood flow
- peripheral venous disease, or general damage in the veins that transport blood from the feet and arms back to the heart, which causes leg swelling and varicose veins
- ischemic stroke, in which a blood clot moves to the brain and causes damage
- venous blood clots, which can break loose and become dangerous if they travel to the pulmonary artery
- blood clotting disorders, in which blood clots form too quickly or not quickly enough and lead to excessive bleeding or clotting
- Buerger's disease, which leads to blood clots and inflammation, often in the legs, and which may result in gangrene

It is possible to manage some health conditions within CVD by making lifestyle changes, but some conditions may be life threatening and require emergency surgery.

Symptoms

Symptoms will vary depending on the specific condition. Some conditions, such as type 2 diabetes or hypertension, may initially cause no symptoms at all.

However, typical symptoms of an underlying cardiovascular issue include:

- pain or pressure in the chest, which may indicate angina
- pain or discomfort in the arms, left shoulder, elbows, jaw, or back
- shortness of breath
- nausea and fatigue
- lightheadedness or dizziness
- cold sweats

Although these are the most common ones, CVD can cause symptoms anywhere in the body.

Lifestyle tips

Share on PinterestRegular exercise can help prevent CVD.

People can take the following steps to prevent some of the conditions within CVD:

- **Manage body weight:** The National Institute of Diabetes and Digestive and Kidney Disorders advise that if a person loses 5–10% of their body weight, they may reduce their risk of developing CVD.
- **Get regular exercise:** The American Heart Association (AHA) recommend doing 150 minutes of moderate-to-intense physical activity every week.

- **Follow a heart-healthy diet:** Eating foods that contain polyunsaturated fats and omega-3, such as oily fish, alongside fruits and vegetables can support heart health and reduce the risk of CVD. Reducing the intake of processed food, salt, saturated fat, and added sugar has a similar effect.
- **Quit smoking:** Smoking is a key risk factor for almost all forms of CVD. Although quitting can be difficult, taking steps to do so can drastically reduce its damaging effects on the heart.

Treatment

The treatment option that is best for a person will depend on their specific type of CVD.

However, some options include:

- medication, such as to reduce low density lipoprotein cholesterol, improve blood flow, or regulate heart rhythm
- surgery, such as coronary artery bypass grafting or valve repair or replacement surgery
- cardiac rehabilitation, including exercise prescriptions and lifestyle counseling

Treatment aims to:

- relieve symptoms
- reduce the risk of the condition or disease recurring or getting worse
- prevent complications, such as hospital admission, heart failure, stroke, heart attack, or death

Depending on the condition, a healthcare provider may also seek to stabilize heart rhythms, reduce blockages, and relax the arteries to enable a better flow of blood.

Risk factors

High blood pressure is a risk factor for CVD.

Researchers reported in the journal *JAMA* that the lifetime risk of CVD is more than *50%* for both men and women.

Their study paper notes that even among those with few or no cardiovascular risk factors, the risk is still higher than 30%.

Risk factors for CVD include:

- high blood pressure, or hypertension
- atherosclerosis or blockages in the arteries
- radiation therapy
- smoking
- poor sleep hygiene

- high blood cholesterol, or hyperlipidemia
- diabetes
- a high fat, high carbohydrate diet
- physical inactivity
- obesity
- sleep apnea
- excessive alcohol consumption
- stress
- air pollution
- chronic obstructive pulmonary disorder or other forms of reduced lung function

People with one cardiovascular risk factor often have more. For example, obesity is a risk factor for high blood pressure, high blood cholesterol, and type 2 diabetes. A person may have all four conditions at the same time.

Causes

Many types of CVD occur as a complication of atherosclerosis.

Damage to the circulatory system can also result from diabetes and other health conditions, such as a virus, an inflammatory process such as myocarditis, or a structural problem present from birth (congenital heart disease).

CVD often results from high blood pressure, which produces no symptoms. It is therefore vital that people undergo regular screening for high blood pressure.

Prevention

Many types of CVD are preventable. It is vital to address risk factors by taking the following steps:

- reducing the use of alcohol and tobacco
- eating fresh fruit and vegetables
- reducing salt, sugar, and saturated fat intake
- avoiding a sedentary lifestyle, particularly for children

Adopting damaging lifestyle habits, such as eating a high sugar diet and not getting much physical activity, may not lead to CVD while a person is still young, as the effects of the condition are cumulative.

However, continued exposure to these risk factors can contribute to the development of CVD later in life.

Cancer

Cancer refers to any one of a large number of diseases characterized by the development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue. Cancer often has the ability to spread throughout your body.

Cancer is the second-leading cause of death in the world. But survival rates are improving for many types of cancer, thanks to improvements in cancer screening, treatment and prevention.

Symptoms

Signs and symptoms caused by cancer will vary depending on what part of the body is affected.

Some general signs and symptoms associated with, but not specific to, cancer, include:

- Fatigue
- Lump or area of thickening that can be felt under the skin
- Weight changes, including unintended loss or gain
- Skin changes, such as yellowing, darkening or redness of the skin, sores that won't heal, or changes to existing moles
- Changes in bowel or bladder habits
- Persistent cough or trouble breathing
- Difficulty swallowing
- Hoarseness
- Persistent indigestion or discomfort after eating
- Persistent, unexplained muscle or joint pain
- Persistent, unexplained fevers or night sweats
- Unexplained bleeding or bruising

When to see a doctor

Make an appointment with your doctor if you have any persistent signs or symptoms that concern you.

If you don't have any signs or symptoms, but are worried about your risk of cancer, discuss your concerns with your doctor. Ask about which cancer screening tests and procedures are appropriate for you.

Causes

Cancer is caused by changes (mutations) to the DNA within cells. The DNA inside a cell is packaged into a large number of individual genes, each of which contains a set of instructions telling the cell what functions to perform, as well as how to grow and divide. Errors in the instructions can cause the cell to stop its normal function and may allow a cell to become cancerous.

What do gene mutations do?

A gene mutation can instruct a healthy cell to:

- **Allow rapid growth.** A gene mutation can tell a cell to grow and divide more rapidly. This creates many new cells that all have that same mutation.

- **Fail to stop uncontrolled cell growth.** Normal cells know when to stop growing so that you have just the right number of each type of cell. Cancer cells lose the controls (tumor suppressor genes) that tell them when to stop growing. A mutation in a tumor suppressor gene allows cancer cells to continue growing and accumulating.
- **Make mistakes when repairing DNA errors.** DNA repair genes look for errors in a cell's DNA and make corrections. A mutation in a DNA repair gene may mean that other errors aren't corrected, leading cells to become cancerous.

These mutations are the most common ones found in cancer. But many other gene mutations can contribute to causing cancer.

What causes gene mutations?

Gene mutations can occur for several reasons, for instance:

- **Gene mutations you're born with.** You may be born with a genetic mutation that you inherited from your parents. This type of mutation accounts for a small percentage of cancers.
- **Gene mutations that occur after birth.** Most gene mutations occur after you're born and aren't inherited. A number of forces can cause gene mutations, such as smoking, radiation, viruses, cancer-causing chemicals (carcinogens), obesity, hormones, chronic inflammation and a lack of exercise.

Gene mutations occur frequently during normal cell growth. However, cells contain a mechanism that recognizes when a mistake occurs and repairs the mistake. Occasionally, a mistake is missed. This could cause a cell to become cancerous.

How do gene mutations interact with each other?

The gene mutations you're born with and those that you acquire throughout your life work together to cause cancer.

For instance, if you've inherited a genetic mutation that predisposes you to cancer, that doesn't mean you're certain to get cancer. Instead, you may need one or more other gene mutations to cause cancer. Your inherited gene mutation could make you more likely than other people to develop cancer when exposed to a certain cancer-causing substance.

It's not clear just how many mutations must accumulate for cancer to form. It's likely that this varies among cancer types.

Risk factors

While doctors have an idea of what may increase your risk of cancer, the majority of cancers occur in people who don't have any known risk factors. Factors known to increase your risk of cancer include:

Your age

Cancer can take decades to develop. That's why most people diagnosed with cancer are 65 or older. While it's more common in older adults, cancer isn't exclusively an adult disease — cancer can be diagnosed at any age.

Your habits

Certain lifestyle choices are known to increase your risk of cancer. Smoking, drinking more than one drink a day for women and up to two drinks a day for men, excessive exposure to the sun or frequent blistering sunburns, being obese, and having unsafe sex can contribute to cancer.

You can change these habits to lower your risk of cancer — though some habits are easier to change than others.

Your family history

Only a small portion of cancers are due to an inherited condition. If cancer is common in your family, it's possible that mutations are being passed from one generation to the next. You might be a candidate for genetic testing to see whether you have inherited mutations that might increase your risk of certain cancers. Keep in mind that having an inherited genetic mutation doesn't necessarily mean you'll get cancer.

Your health conditions

Some chronic health conditions, such as ulcerative colitis, can markedly increase your risk of developing certain cancers. Talk to your doctor about your risk.

Your environment

The environment around you may contain harmful chemicals that can increase your risk of cancer. Even if you don't smoke, you might inhale secondhand smoke if you go where people are smoking or if you live with someone who smokes. Chemicals in your home or workplace, such as asbestos and benzene, also are associated with an increased risk of cancer.

Complications

Cancer and its treatment can cause several complications, including:

- **Pain.** Pain can be caused by cancer or by cancer treatment, though not all cancer is painful. Medications and other approaches can effectively treat cancer-related pain.
- **Fatigue.** Fatigue in people with cancer has many causes, but it can often be managed. Fatigue associated with chemotherapy or radiation therapy treatments is common, but it's usually temporary.
- **Difficulty breathing.** Cancer or cancer treatment may cause a feeling of being short of breath. Treatments may bring relief.
- **Nausea.** Certain cancers and cancer treatments can cause nausea. Your doctor can sometimes predict if your treatment is likely to cause nausea. Medications and other treatments may help you prevent or decrease nausea.
- **Diarrhea or constipation.** Cancer and cancer treatment can affect your bowels and cause diarrhea or constipation.
- **Weight loss.** Cancer and cancer treatment may cause weight loss. Cancer steals food from normal cells and deprives them of nutrients. This is often not affected by how many calories or what kind of food is eaten; it's difficult to treat. In most cases, using artificial nutrition through tubes into the stomach or vein does not help change the weight loss.
- **Chemical changes in your body.** Cancer can upset the normal chemical balance in your body and increase your risk of serious complications. Signs and symptoms of chemical imbalances might include excessive thirst, frequent urination, constipation and confusion.

- **Brain and nervous system problems.** Cancer can press on nearby nerves and cause pain and loss of function of one part of your body. Cancer that involves the brain can cause headaches and stroke-like signs and symptoms, such as weakness on one side of your body.
- **Unusual immune system reactions to cancer.** In some cases the body's immune system may react to the presence of cancer by attacking healthy cells. Called paraneoplastic syndromes, these very rare reactions can lead to a variety of signs and symptoms, such as difficulty walking and seizures.
- **Cancer that spreads.** As cancer advances, it may spread (metastasize) to other parts of the body. Where cancer spreads depends on the type of cancer.
- **Cancer that returns.** Cancer survivors have a risk of cancer recurrence. Some cancers are more likely to recur than others. Ask your doctor about what you can do to reduce your risk of cancer recurrence. Your doctor may devise a follow-up care plan for you after treatment. This plan may include periodic scans and exams in the months and years after your treatment, to look for cancer recurrence.

Prevention

Doctors have identified several ways to reduce your risk of cancer, such as:

- **Stop smoking.** If you smoke, quit. If you don't smoke, don't start. Smoking is linked to several types of cancer — not just lung cancer. Stopping now will reduce your risk of cancer in the future.
- **Avoid excessive sun exposure.** Harmful ultraviolet (UV) rays from the sun can increase your risk of skin cancer. Limit your sun exposure by staying in the shade, wearing protective clothing or applying sunscreen.
- **Eat a healthy diet.** Choose a diet rich in fruits and vegetables. Select whole grains and lean proteins. Limit your intake of processed meats.
- **Exercise most days of the week.** Regular exercise is linked to a lower risk of cancer. Aim for at least 30 minutes of exercise most days of the week. If you haven't been exercising regularly, start out slowly and work your way up to 30 minutes or longer.
- **Maintain a healthy weight.** Being overweight or obese may increase your risk of cancer. Work to achieve and maintain a healthy weight through a combination of a healthy diet and regular exercise.
- **Drink alcohol in moderation, if you choose to drink.** If you choose to drink alcohol, do so in moderation. For healthy adults, that means up to one drink a day for women and up to two drinks a day for men.
- **Schedule cancer screening exams.** Talk to your doctor about what types of cancer screening exams are best for you based on your risk factors.
- **Ask your doctor about immunizations.** Certain viruses increase your risk of cancer. Immunizations may help prevent those viruses, including hepatitis B, which increases the risk of liver cancer, and human papillomavirus (HPV), which increases the risk of cervical cancer and other cancers. Ask your doctor whether immunization against these viruses is appropriate for you.

Alcohol

Symptoms

Alcohol use disorder can be mild, moderate or severe, based on the number of symptoms you experience. Signs and symptoms may include:

- Being unable to limit the amount of alcohol you drink
- Wanting to cut down on how much you drink or making unsuccessful attempts to do so
- Spending a lot of time drinking, getting alcohol or recovering from alcohol use
- Feeling a strong craving or urge to drink alcohol
- Failing to fulfill major obligations at work, school or home due to repeated alcohol use
- Continuing to drink alcohol even though you know it's causing physical, social or interpersonal problems
- Giving up or reducing social and work activities and hobbies
- Using alcohol in situations where it's not safe, such as when driving or swimming
- Developing a tolerance to alcohol so you need more to feel its effect or you have a reduced effect from the same amount
- Experiencing withdrawal symptoms — such as nausea, sweating and shaking — when you don't drink, or drinking to avoid these symptoms

Alcohol use disorder can include periods of alcohol intoxication and symptoms of withdrawal.

- **Alcohol intoxication** results as the amount of alcohol in your bloodstream increases. The higher the blood alcohol concentration is, the more impaired you become. Alcohol intoxication causes behavior problems and mental changes. These may include inappropriate behavior, unstable moods, impaired judgment, slurred speech, impaired attention or memory, and poor coordination. You can also have periods called "blackouts," where you don't remember events. Very high blood alcohol levels can lead to coma or even death.
- **Alcohol withdrawal** can occur when alcohol use has been heavy and prolonged and is then stopped or greatly reduced. It can occur within several hours to four or five days later. Signs and symptoms include sweating, rapid heartbeat, hand tremors, problems sleeping, nausea and vomiting, hallucinations, restlessness and agitation, anxiety, and occasionally seizures. Symptoms can be severe enough to impair your ability to function at work or

When to see a doctor?

If you feel that you sometimes drink too much alcohol, or your drinking is causing problems, or your family is concerned about your drinking, talk with your doctor. Other ways to get help include talking with a mental health professional or seeking help from a support group such as Alcoholics Anonymous or a similar type of self-help group.

Because denial is common, you may not feel like you have a problem with drinking. You might not recognize how much you drink or how many problems in your life are related to alcohol use. Listen to relatives, friends or co-workers when they ask you to examine your drinking habits or to seek help. Consider talking with someone who has had a problem drinking, but has stopped.

If your loved one needs help

Many people with alcohol use disorder hesitate to get treatment because they don't recognize they have a problem. An intervention from loved ones can help some people recognize and accept that they need professional help. If you're concerned about someone who drinks too much, ask a professional experienced in alcohol treatment for advice on how to approach that person.

Causes

Genetic, psychological, social and environmental factors can impact how drinking alcohol affects your body and behavior. Theories suggest that for certain people drinking has a different and stronger impact that can lead to alcohol use disorder.

Over time, drinking too much alcohol may change the normal function of the areas of your brain associated with the experience of pleasure, judgment and the ability to exercise control over your behavior. This may result in craving alcohol to try to restore good feelings or reduce negative ones.

Risk factors

Alcohol use may begin in the teens, but alcohol use disorder occurs more frequently in the 20s and 30s, though it can start at any age.

- **Steady drinking over time.** Drinking too much on a regular basis for an extended period or binge drinking on a regular basis can lead to alcohol-related problems or alcohol use disorder.
- **Starting at an early age.** People who begin drinking — especially binge drinking — at an early age are at a higher risk of alcohol use disorder.
- **Family history.** The risk of alcohol use disorder is higher for people who have a parent or other close relative who has problems with alcohol. This may be influenced by genetic factors.
- **Depression and other mental health problems.** It's common for people with a mental health disorder such as anxiety, depression, schizophrenia or bipolar disorder to have problems with alcohol or other substances.
- **History of trauma.** People with a history of emotional or other trauma are at increased risk of alcohol use disorder.
- **Having bariatric surgery.** Some research studies indicate that having bariatric surgery may increase the risk of developing alcohol use disorder or of relapsing after recovering from alcohol use disorder.

- **Social and cultural factors.** Having friends or a close partner who drinks regularly could increase your risk of alcohol use disorder. The glamorous way that drinking is sometimes portrayed in the media also may send the message that it's OK to drink too much. For young people, the influence of parents, peers and other role models can impact risk.

Complications

Alcohol depresses your central nervous system. In some people, the initial reaction may be stimulation. But as you continue to drink, you become sedated.
Too much alcohol affects your speech, muscle coordination and vital centers of your brain. A heavy drinking binge may even cause a life-threatening coma or death. This is of particular concern when you're taking certain medications that also depress the brain's function.

Impact on your safety
Excessive drinking can reduce your judgment skills and lower inhibitions, leading to poor choices and dangerous situations or behaviors, including:

- Motor vehicle accidents and other types of accidental injury, such as drowning
- Relationship problems
- Poor performance at work or school
- Increased likelihood of committing violent crimes or being the victim of a crime
- Legal problems or problems with employment or finances
- Problems with other substance use
- Engaging in risky, unprotected sex, or experiencing sexual abuse or date rape
- Increased risk of attempted or completed suicide

Impact on your health
Drinking too much alcohol on a single occasion or over time can cause health problems, including:

- **Liver disease.** Heavy drinking can cause increased fat in the liver (hepatic steatosis), inflammation of the liver (alcoholic hepatitis), and over time, irreversible destruction and scarring of liver tissue (cirrhosis).
- **Digestive problems.** Heavy drinking can result in inflammation of the stomach lining (gastritis), as well as stomach and esophageal ulcers. It can also interfere with absorption of B vitamins and other nutrients. Heavy drinking can damage your pancreas or lead to inflammation of the pancreas (pancreatitis).
- **Heart problems.** Excessive drinking can lead to high blood pressure and increases your risk of an enlarged heart, heart failure or stroke. Even a single binge can cause a serious heart arrhythmia called atrial fibrillation.
- **Diabetes complications.** Alcohol interferes with the release of glucose from your liver and can increase the risk of low blood sugar (hypoglycemia). This is dangerous if you have diabetes and are already taking insulin to lower your blood sugar level.

- **Sexual function and menstruation issues.** Excessive drinking can cause erectile dysfunction in men. In women, it can interrupt menstruation.
- **Eye problems.** Over time, heavy drinking can cause involuntary rapid eye movement (nystagmus) as well as weakness and paralysis of your eye muscles due to a deficiency of vitamin B-1 (thiamin). A thiamin deficiency can also be associated with other brain changes, such as irreversible dementia, if not promptly treated.
- **Birth defects.** Alcohol use during pregnancy may cause miscarriage. It may also cause fetal alcohol syndrome, resulting in giving birth to a child who has physical and developmental problems that last a lifetime.
- **Bone damage.** Alcohol may interfere with the production of new bone. This bone loss can lead to thinning bones (osteoporosis) and an increased risk of fractures. Alcohol can also damage bone marrow, which makes blood cells. This can cause a low platelet count, which may result in bruising and bleeding.
- **Neurological complications.** Excessive drinking can affect your nervous system, causing numbness and pain in your hands and feet, disordered thinking, dementia, and short-term memory loss.
- **Weakened immune system.** Excessive alcohol use can make it harder for your body to resist disease, increasing your risk of various illnesses, especially pneumonia.
- **Increased risk of cancer.** Long-term, excessive alcohol use has been linked to a higher risk of many cancers, including mouth, throat, liver, esophagus, colon and breast cancers. Even moderate drinking can increase the risk of breast cancer.
- **Medication and alcohol interactions.** Some medications interact with alcohol, increasing its toxic effects. Drinking while taking these medications can either increase or decrease their effectiveness, or make them dangerous.

Prevention

Early intervention can prevent alcohol-related problems in teens. If you have a teenager, be alert to signs and symptoms that may indicate a problem with alcohol:

- Loss of interest in activities and hobbies and in personal appearance
- Red eyes, slurred speech, problems with coordination and memory lapses
- Difficulties or changes in relationships with friends, such as joining a new crowd
- Declining grades and problems in school
- Frequent mood changes and defensive behavior

You can help prevent teenage alcohol use:

- Set a good example with your own alcohol use.
- Talk openly with your child, spend quality time together and become actively involved in your child's life.
- Let your child know what behavior you expect — and what the consequences will be if he or she doesn't follow the rules.

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