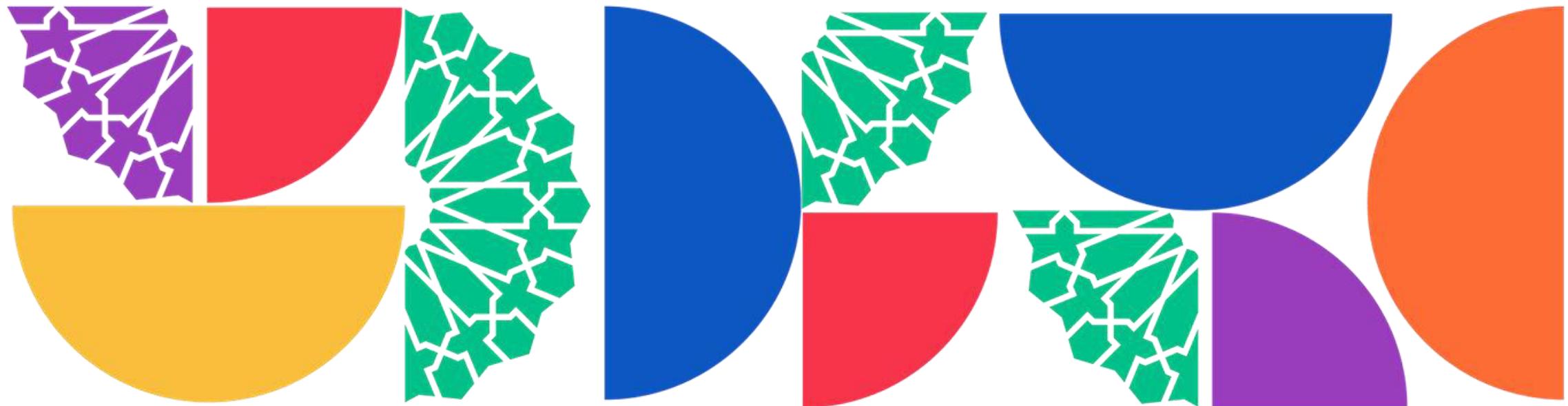


Health Awareness and Nutrition

Vitamins

Department of Clinical Nutrition and Dietetics
College of Health Sciences



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www.sharjah.ac.ae

Vitamins



Characteristics of Vitamins

Structure

Vitamins are individual units as they are not linked together like carbohydrates or protein.

Food Contents

The amounts of vitamins people require are measured in micrograms (μg) or milligrams (mg).

Function

- Essential nutrients (**Organic**)
- Vitamins don't provide energy (**Non-caloric**)
- Cannot be synthesized in sufficient quantities and **must be obtained from the diet**
- They facilitate the chemical reactions that produce skin, bone, and muscle
- Lack of one or more of vitamins, a person may develop a deficiency disease
- Necessary for specific metabolic reactions and components of body tissue structure

Classification of Vitamins

Vitamins are classified according to their solubility as:

Fat-soluble (liposoluble) vitamins



Vitamin A, D, E, K
4 Vitamins

Water-soluble (hydro-soluble) vitamins



B Vitamins, Vitamin C
9 Vitamins

Classification of Vitamins

Vitamins are classified according to their solubility as:

Fat-soluble (liposoluble) vitamins



- Absorbed through the intestinal tract **with the help of fats**
- Generally stored and **accumulate in the body** ↗ become toxic in large doses
- Symptoms of **deficiency develop relatively late** after their intake has been reduced

Water-soluble (hydro-soluble) vitamins



- They **are not stored in the body** (are excreted in the urine)
- Symptoms of **deficiency develop early**
- Consistent (regular) intake is needed

Fat-Soluble Vitamins



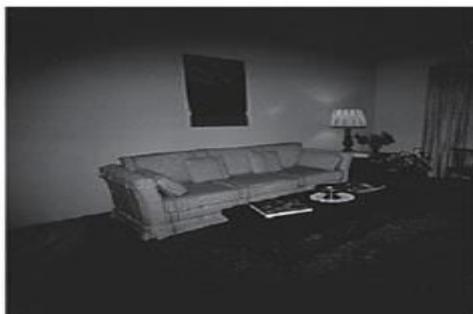
Vitamin A

Functions

Role in vision: Help in vision in dim light “night blindness”

Role in growth: Necessary for the development of skeletal and soft tissues

Role in maintenance of epithelia: Skin, cornea, mucous membranes



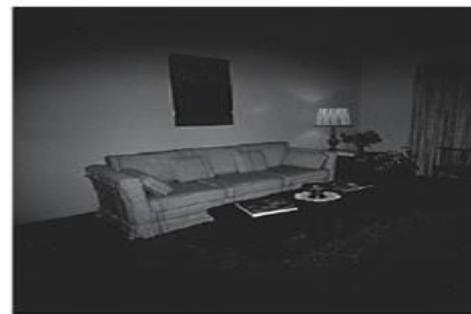
In dim light, you can make out the details in this room.



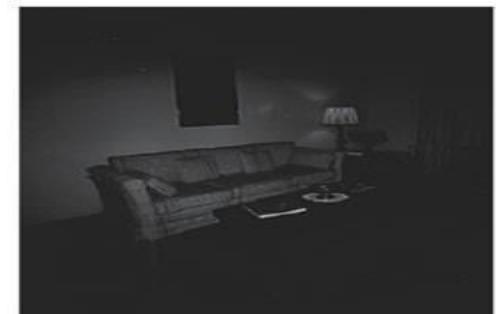
A flash of bright light momentarily blinds you as the pigment in the retina is bleached.

Reproduction: In women, Vitamin A supports normal fetal development during pregnancy. In men, Vitamin A participates in sperm development. Children lacking Vitamin A fail to grow.

Immunity and Antioxidant (as beta-carotene): Protects the body against disease



You quickly recover and can see the details again in a few seconds.



With inadequate vitamin A, you do not recover but remain blind for many seconds; this is night blindness.

Vitamin A

Sources



→ Preformed Vitamin A (Retinol)

- **Animal food**

Liver, fish, meat, eggs

Milk and milk products (cheese, cream, butter, fortified margarine)

→ Provitamin A (Beta-carotene)

- **Plant food**

Orange-yellow-red- vegetables and fruits (carrots, apricots, sweet potatoes, pumpkin)

Dark green leafy vegetables (spinach, broccoli)

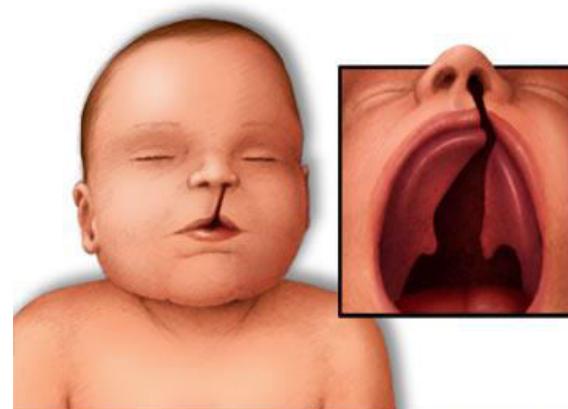
Vitamin A



Deficiency

Night blindness

Impaired immunity



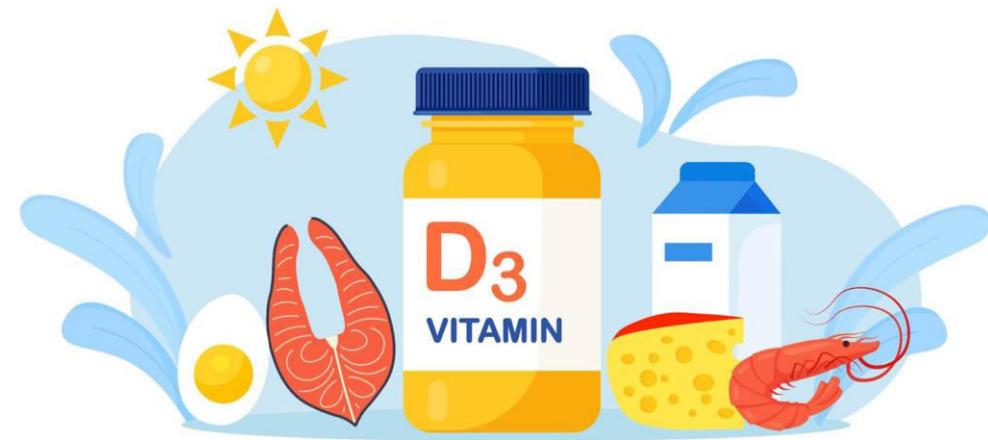
Toxicity

Birth defects: excess of Vitamin A can cause toxicity in the newborn (cleft lip)
Excess of Beta-carotene causes harmless yellowing of the skin



Vitamin D

- ❑ Vitamin D helps **regulate the amount of calcium and phosphate** in the body.
- ❑ These nutrients are needed to keep **bones, teeth** and **muscles healthy**.
- ❑ **Calcium**, the primary component of bone, **cannot be absorbed without** the presence of **Vitamin D**.
- ❑ The body produces vitamin D **naturally** when it's directly exposed to **sunlight**.
- ❑ **Few foods** naturally contain vitamin D.



Vitamin D



Functions

Mineralization of bones: raises blood calcium and phosphorus by increasing absorption from the digestive tract, releasing calcium from the bones, and stimulating retention by the kidneys

Essential for calcium deposition in bones and teeth

Stimulates normal bone development

Permits normal skeletal growth

Vitamin D

Sources

Synthesized in the body under sunlight exposure

Richest food sources: fatty fish such as salmon and sardines (and their oils), egg yolks, liver

Vitamin D fortified sources: fortified milk, margarine, butter, and cereals



Vitamin D

Deficiency



Factors that contribute to deficiency:

A deficiency in vitamin D can result from inadequate exposure to sunlight, inefficient production in the skin, not enough vitamin D in your diet, or darker skin (the higher the levels of melanin pigment, the less UV rays are absorbed and the less vitamin D will be synthesized).

Deficient calcium deposition → bone malformation or deterioration.

Vitamin D

Deficiency

In children – Rickets

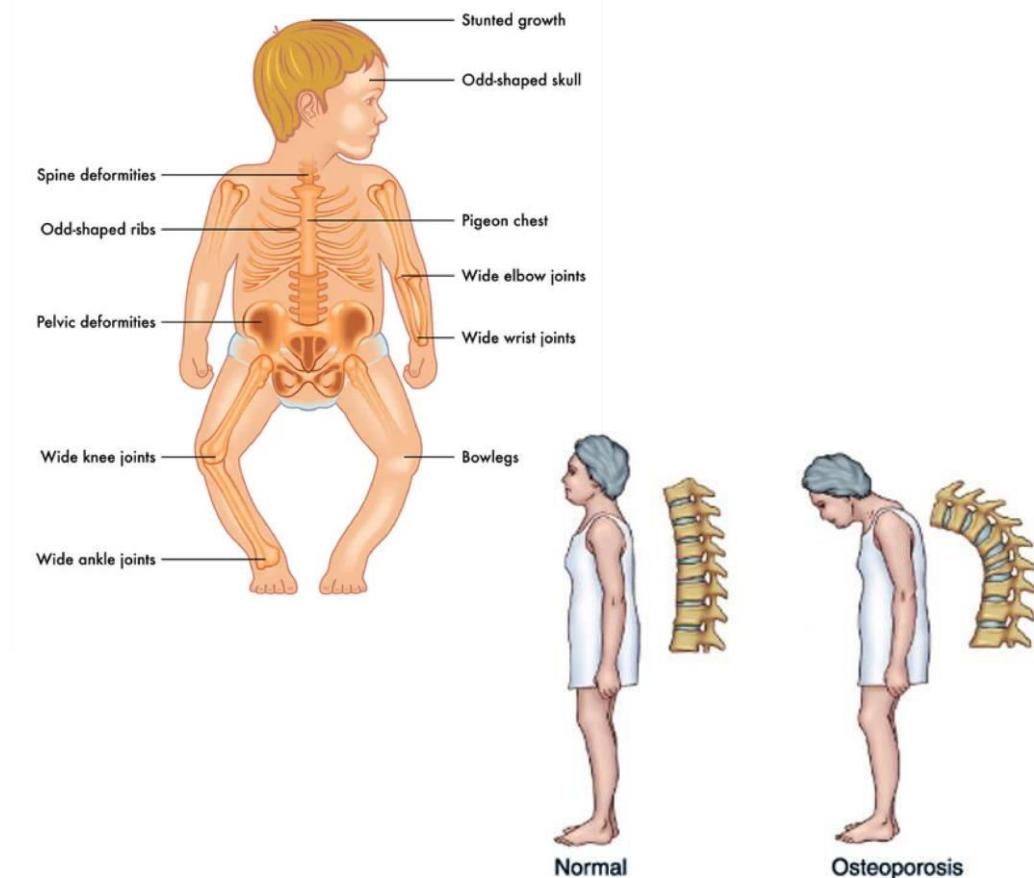
Characterized by poor developed bones (bowed legs)

In adults – Osteomalacia

Loss of calcium

Soft, flexible, brittle, and deformed bones and bending of spine

Progressive weakness and pain in lower back and legs



Osteoporosis

Risk factors

It is a **disease of bones** that leads to **an increased risk of fractures** caused by **severe Vitamin D deficiency**.

It is characterized by the **loss of the bone mineral density** (BMD) making them **fragile** (weak & delicate) and more likely to break.



Family history



Gender: more common in women



Age: risk increases with age



Nutrient deficiencies:
Calcium and Vitamin D



Certain medications:
hormone therapy (steroids)



Body weight: underweight and obesity



Poor lifestyle habits:
smoking, alcohol, caffeine



Sedentary lifestyle

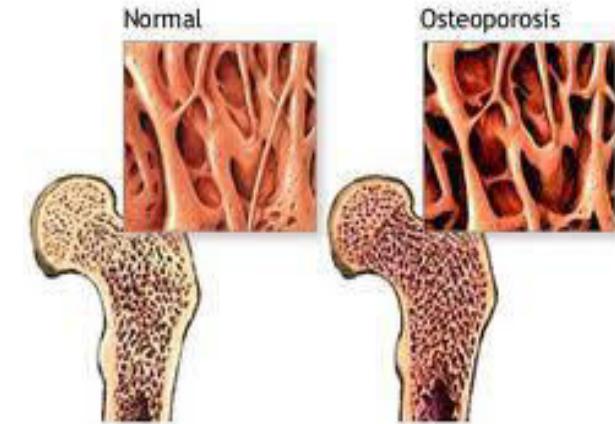
Osteoporosis

Symptoms

- May cause **no symptoms initially**
- Later, it may cause **dull pain in the bones or muscles**, particularly in **lower back or neck**
- Later in the course of the disease, **sharp pains may come on suddenly**

Diagnosis

Anyone “**at risk**” for osteoporosis should have their bone density checked. A Bone Density Test (**Densitometry**) can be performed for patients who may have osteoporosis. **Bone Density Tests** are also useful to **monitor the progression** of osteoporosis and the **response to treatments**.



Osteoporosis

Prevention

Exercise and lifestyle: walking or aerobics and light weight bearing

A diet containing all the nutrients in optimum amounts plus calcium supplements may be taken on prescription along with vitamin D if someone's dietary intake is low and absorption is poor.



Exercise: Walking and light aerobics and avoid heavy training



Eat foods that are high in calcium: dairy products, dark green leafy vegetables, nuts, dried fruits, fish, tofu

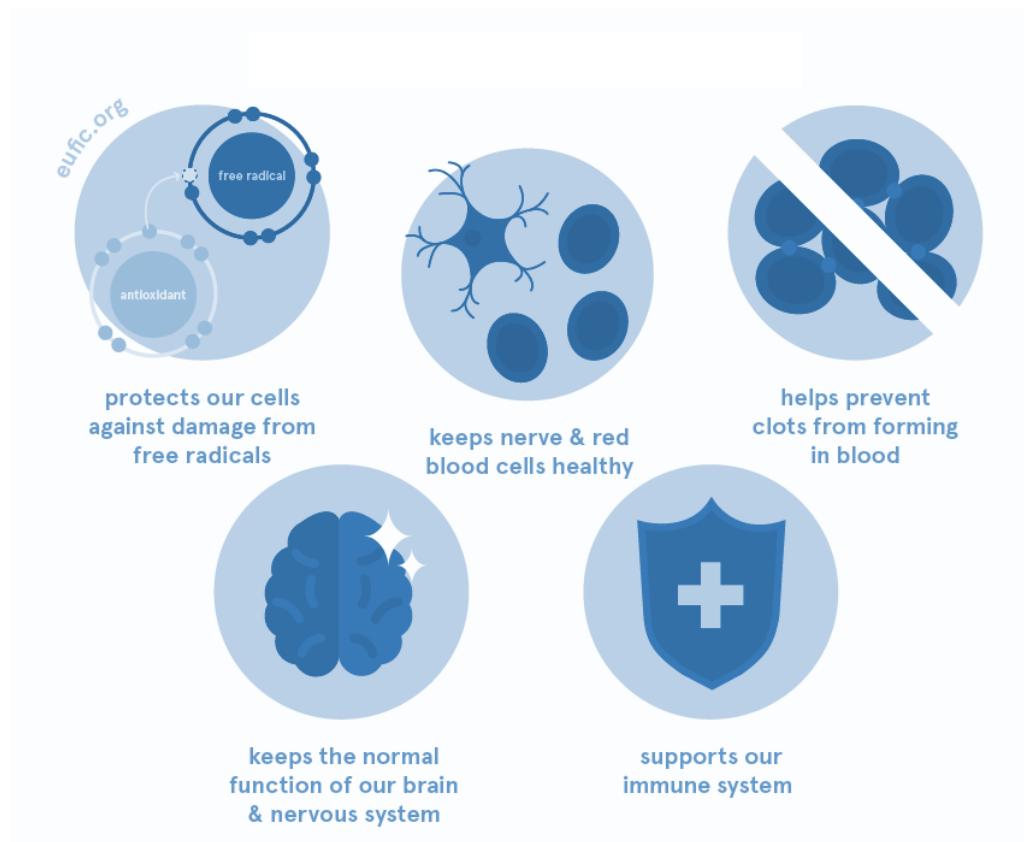


Supplements: Take calcium and Vitamin D supplements



Stop smoking and alcohol intake

Vitamin E



Functions

Anti-sterility: Helps in reproduction

Antioxidant (along with Vitamin A and C):

- Stabilization of cell membranes
- Regulation of oxidation reactions

Vitamin E

Sources

Vitamin E is widespread in food, making it difficult to create a vitamin E-deficient diet

It can be easily destroyed by heat and oxygen

Best sources: plant seed oils such as soybean, sunflower, corn oil, nuts, olives, green leafy vegetables



Olive Oil



Coconut Oil



Sunflower Oil



Broccoli



Spinach



Kale



Avocado



Almonds



Peanuts

Vitamin K



Functions

Blood coagulation: necessary for the formation of blood clotting proteins

Sources

Best sources: green leafy vegetables (spinach, lettuce, broccoli and other members of the cabbage family)

Non-dietary source: Significant amounts produced by intestinal bacteria

Vitamin K



Deficiency

Vitamin K deficiency results in **hemorrhage**

Unlikely in adults.

- **At Risk:** Newborns who fail to establish intestinal bacteria that produce Vitamin K
- At birth newborns are given a dose of Vitamin K to hold them until vitamin K-producing bacteria establish themselves in their intestinal tract



Water-Soluble Vitamins

Water-Soluble Vitamins

General function:

The B and C vitamins help enzymes in their function: are **cofactors** in enzymatic reactions

Involved in energy (Adenosine triphosphate-ATP) production reactions: ATP is able to store and transport chemical energy within cells.

9 Water-soluble Vitamins

- Vitamin B₁ (Thiamine)
- Vitamin B₂ (Riboflavin)
- Vitamin B₃ (Niacin)
- Vitamin B₅ (Pantothenic acid)
- Vitamin B₆ (Pyridoxine)
- Vitamin B₇ (Biotin)
- Vitamin B₉ (Folic acid)
- Vitamin B₁₂ (Cobalamin)
- Vitamin C (ascorbic acid)

Thiamin (B1)

Functions

It is needed as a coenzyme for **energy metabolism**

Proper function of the **nervous system**

Sources

Whole grains, nuts

Found in a lot of foods

Deficiency

Not very common nowadays

Beriberi: weakness in nerves



Riboflavin (B2)



Functions

It is needed as a coenzyme for **energy metabolism**
Maintain integrity of **epithelial & mucosal linings**

Sources

Milk products (yogurt, cheese)
Whole grains
Liver, eggs, green leafy vegetables

Riboflavin (B2)

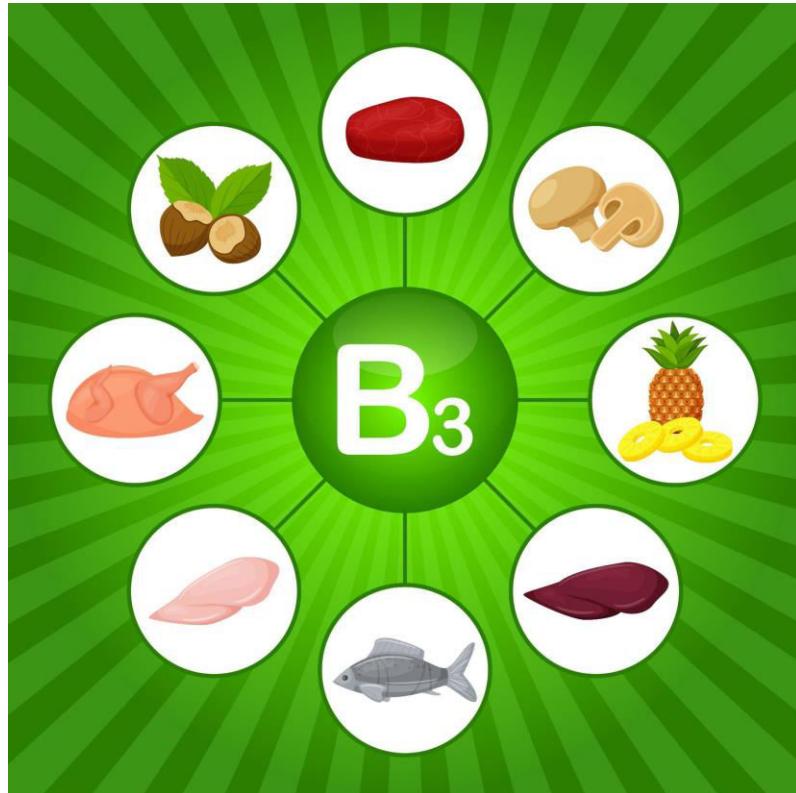
Deficiency

Ariboflavinosis: (dryness & cracking of lips)

Cracks and redness at corners of mouth
Painful, smooth, purplish red tongue



Niacin (B3)



Functions

It is needed as a coenzyme for **energy metabolism**
Proper function of the **digestive and nervous systems**

Sources

Milk, meat, poultry, fish
Whole-grains and legumes, liver, eggs, nuts

Deficiency

Pellagra: diarrhea, dryness of skin, memory loss
3 Ds of Pellagra: are diarrhea, dermatitis, dementia and
if untreated- death

Pyridoxine (B6)

Functions

It is needed as a coenzyme for **energy metabolism**
Helps the process of producing red blood cells

Sources

Milk, meat, poultry, fish, liver
Potatoes and starchy vegetables and legumes
Non-citric fruits

Deficiency

Dermatitis
Anemia (microcytic anemia)
Depression and confusion



Folic Acid (B9)

Functions

It is needed as coenzyme for **energy metabolism**
Normal development of **red blood cells in the bone marrow**
Help **synthesize DNA** especially for the fetus



Sources

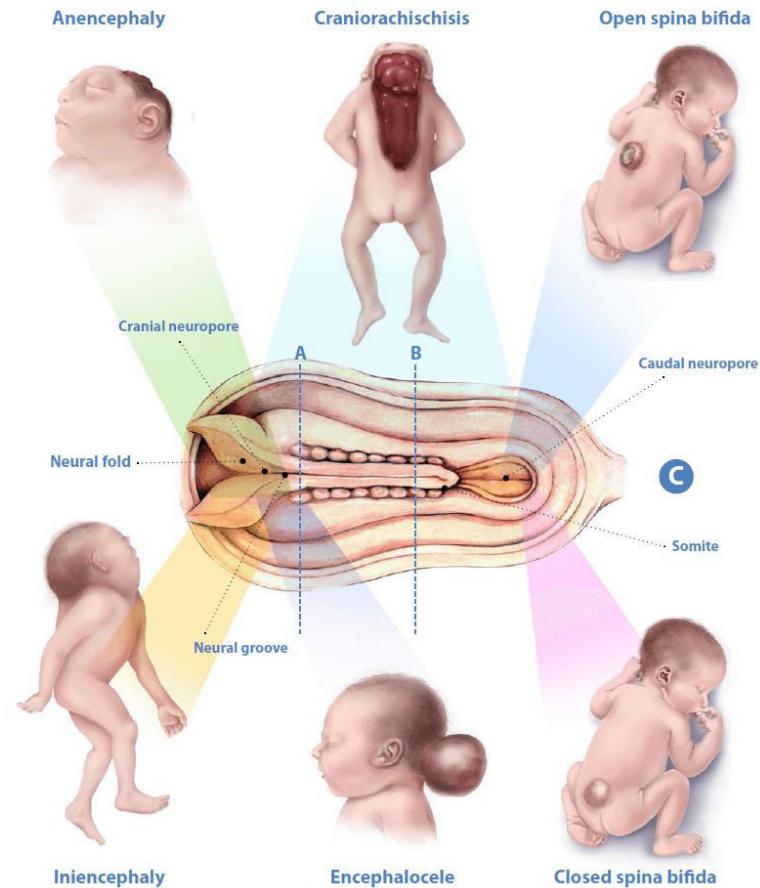
Green leafy vegetables, fruits, legumes, whole grains, organ meats, liver, eggs

Folic Acid (B9)

Deficiency

Birth defect (neural tube defects): brain, spine, or spinal cord defects

Megaloblastic anemia: poor development of blood cells, particularly during pregnancy



Cobalamin (B12)



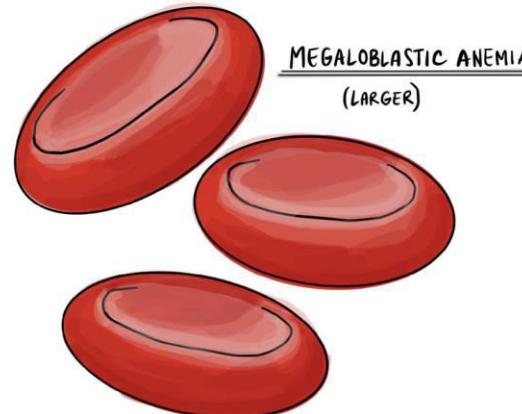
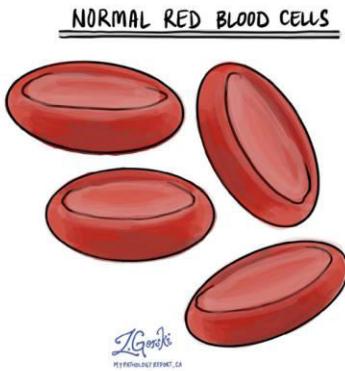
Functions

It is needed as a coenzyme for **energy metabolism**
Works with folic acid to **form red blood cells**
It is important for normal functioning of **nerve tissue**

Sources

Only found in food from animal source: Meat, fish, liver, poultry, milk, cheese, eggs
Strict vegetarians → need supplements of Vitamin B12
Easily destroyed by microwave cooking.

Cobalamin (B12)



Deficiency

Deficiency may cause **megaloblastic anemia**, particularly during pregnancy

Fatigue is another symptom of deficiency

Ascorbic Acid (Vitamin C)

Functions

Involved in **collagen synthesis** (protein in bones, cartilage, skin) → important in healing of fractures and wounds

- **Strengthens the immune system**
- **Increases resistance to cold and infections**
- **Stimulates iron absorption** from plant sources
- **Antioxidant**



Ascorbic Acid (Vitamin C)



Sources

Fresh fruits and vegetables (esp. if acidic)

Processed and cooked foods are **poor sources**

Attention:

Can be easily destroyed by **heat** and upon
exposure to air (oxidation)

Content **decreases** during storage and if **peeled or cut**

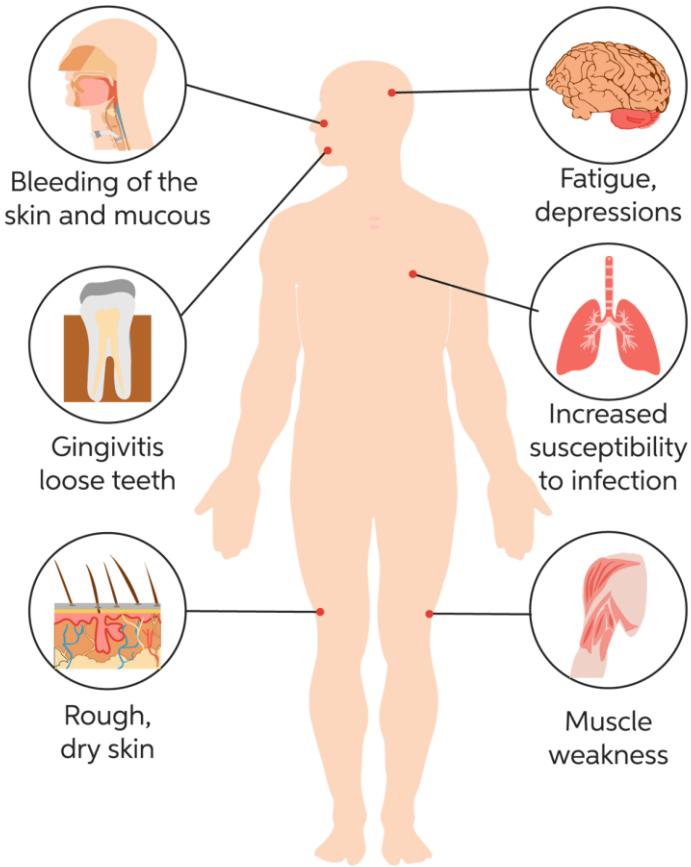
Ascorbic Acid (Vitamin C)

Deficiency

Scurvy

Symptoms include:

- Swollen and inflamed gums
- Loose teeth
- Dryness of eyes and mouth
- Dry itchy skin, hair loss
- Defect in wound healing
- Frequent infections



Vitamin Supplementation



Nearly 40% of the U.S. population take a vitamin supplement.

People who may benefit from vitamin supplements include:

- People with vitamin deficiency
- Women in childbearing years
- Pregnant and lactating women
- People who diet a lot
- Elderly people
- Those recovering from surgery, injury
- Strict vegetarians (vitamin B12)

Vitamin Supplementation

Supplements may be risky if taken...

- By people to feel secure about getting enough nutrients
- By people who have conditions that increase vitamin toxicity (kidney or liver disease)
- To get energy when feeling tired
- To cope with stress
- To build muscles faster
- To prevent/cure self-diagnosed conditions



Information For
Your Interest



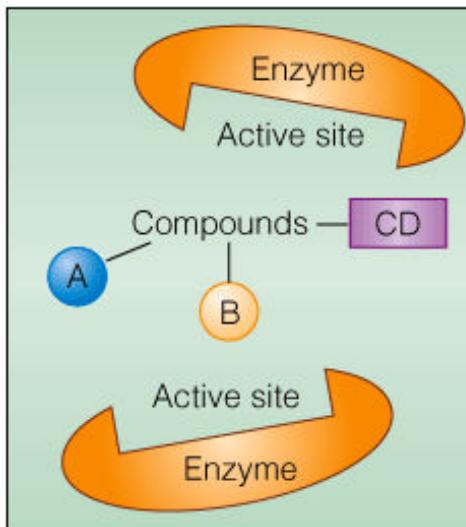
Factors Affecting Vitamin D Synthesis

The more of these factors present in a person's life, the more critical it becomes to obtain vitamin D from food or supplements.

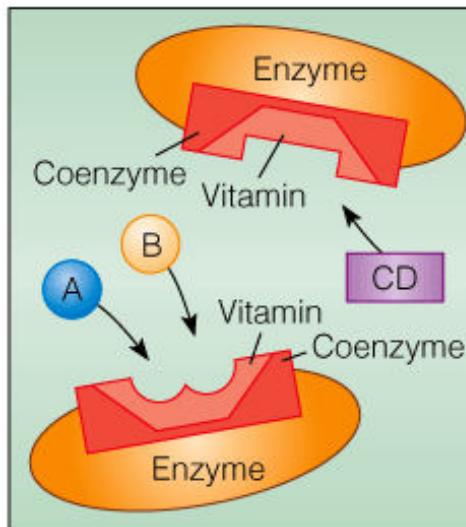
Factor	Effect on Vitamin D Synthesis
Advanced age	With age, the skin loses some of its capacity to synthesize vitamin D.
Air pollution	Particles in the air screen out the sun's rays.
City living	Tall buildings block sunlight.
Clothing	Most clothing blocks sunlight.
Geography	<p>Sunlight exposure is limited:</p> <ul style="list-style-type: none"> September through March at latitudes above 50 degrees (most of Canada) November through February at latitudes between 35 and 50 degrees (most U.S. locations) <p>In locations south of 35 degrees (much of the southern United States), direct sun exposure is sufficient for vitamin D synthesis year-round.</p>
Homebound	Living indoors prevents sun exposure.
Season	Warmer seasons of the year bring more direct sun rays.
Skin pigment	Darker-skinned people synthesize less vitamin D per minute than lighter-skinned people.
Sunscreen	Use reduces or prevents skin exposure to sun's rays.
Time of day	Midday hours bring maximum direct sun exposure.

Water Soluble Vitamins

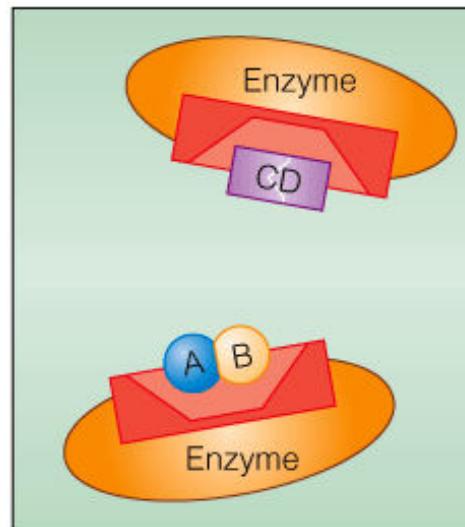
Coenzymes



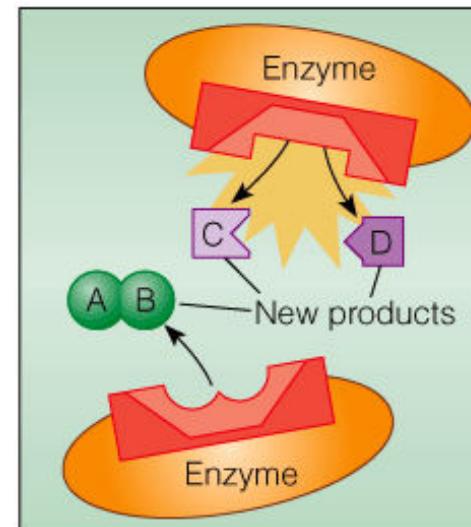
Without coenzymes, compounds A, B, and CD don't respond to their enzymes.



With the coenzymes in place, compounds are attracted to their sites on the enzymes . . .



. . . and the reactions proceed instantaneously. The coenzymes often donate or accept electrons, atoms, or groups of atoms.



The reactions are completed with either the formation of a new product, AB, or the breaking apart of a compound into two new products, C and D, and the release of energy.

Some Valid Reasons for Taking Supplements

These People May Need Supplements:

- People with nutrient deficiencies.
- Women in their childbearing years (supplemental or enrichment sources of folic acid are recommended to reduce risk of neural tube defects in infants).
- Pregnant or lactating women (they may need iron and folate).
- Newborns (they are routinely given a vitamin K dose).
- Infants (they may need various supplements, see Chapter 13).
- Those who are lactose intolerant (they need calcium to forestall osteoporosis).
- Habitual dieters (they may eat insufficient food).

- Elderly people often benefit from some of the vitamins and minerals in a balanced supplement; (they may choose poor diets, have trouble chewing, or absorb or metabolize less efficiently; see Chapter 14).
- Victims of AIDS or other wasting illnesses (they lose nutrients faster than foods can supply them).
- Those addicted to drugs or alcohol (they absorb fewer and excrete more nutrients; nutrients cannot undo damage from drugs or alcohol).
- Those recovering from surgery, burns, injury, or illness (they need extra nutrients to help regenerate tissues).
- Strict vegetarians (they may need vitamin B₁₂, vitamin D, iron, and zinc).
- People taking medications that interfere with the body's use of nutrients.