Vitamins

Vitamins are organic (carbon-containing) compounds that are essential in small amounts for body processes. Vitamins themselves do not provide energy. Vitamins are classified based upon their ability to dissolving, there are ten water-soluble and four fat-soluble vitamins.

Classification

1- Fat-soluble vitamins. The fat-soluble vitamins **A (retinol), D (calciferol) , E (tocopherol), and K (menaquinone and phylloquinone)** are chemically similar. They are not lost easily in cooking but are lost when mineral oil is ingested and very dependent upon the processes of normal lipid digestion and absorption,

2- Water-soluble vitamins. Water-soluble vitamins generally have limited storage ability in the body and are more susceptible to removal from the body in the urine (with the exception of vitamin B12). Therefore, it is logical to think that signs of a deficiency of a water-soluble vitamin may appear more rapidly than would fat-soluble vitamins' symptoms when they are lacking from the diet. This class include **B-complex and vitamin C (ascorbic acid)**. B-complex include Thiamin (B_1), Riboflavin (B_2), Niacin (B_3), Pantothenic acid (B_5), Pyridoxine (B_6), Cobalamin (B_{12}), Biotin (vit. H), Folacin (folic acid or folate) and Choline.

Functions

Vitamins have different functions in various animal species. Vitamins regulate metabolism, help convert fat and carbohydrates into energy and assist in forming bones and tissues.

Minerals

Minerals represent about 5 to 6 percent to total body weight in humans and function in many different ways. Some minerals such as sodium, potassium, and chloride function as electrolytes, while other minerals, such as copper, zinc, iron, chromium, selenium, and manganese can be incorporated into enzyme molecules. Some minerals such as calcium, phosphorus, and fluoride can play a vital structural role in strengthening bones and teeth. After water, minerals are the primary inorganic component of the body; by and large they're the left-over (ash) after cremation of a body, as they will not combust like most organic molecules or evaporate like water.

Water

We thirst for water to maintain good hydration status for optimal health. In fact it is easy to argue that water is our most important nutrient. Each day we must match water intake with losses in order to risk dehydration. Although humans can live about 30 to 45 days without food, it is possible to live only 10 to 14 days without water. Water is a component of all body cells and constitutes from 50% to 60% of the body weight of normal adults. The percentage is higher in males than females because men usually have more muscle tissue than women. The water content of muscle tissue is higher than that of fat tissue. The percentage of water content is highest in newborns (75%) and decreases with age. The access amount of water may be cause water intoxication. We need about 30 ml of water for each kilogram.

Nutrition during aging

1- Nutrition during Pregnancy and Lactation

The tremendous growth of a baby from the moment of conception to the time of birth depends entirely on nourishment from the mother. The complex process of rapid human growth and lactation demands a significant increase in nutrients from the mother's diet. Good nutrition during the 38 to 40 weeks of a normal pregnancy is essential for both mother and child. In addition to her normal nutritional requirements, the pregnant woman must provide nutrients and calories for the fetus, the amniotic fluid, the placenta, and the increased blood volume and breast, uterine, and fat tissue.

ENERGY NEEDS

The metabolic cost of pregnancy is significant over the course of gestation. The exact amount of energy needs will vary greatly among women depending on her prepregnancy weight, health status, and activity level.

Reasons for Increased Need

During the second and third trimesters of pregnancy, the mother needs more kilocalories for two general reasons:

(1) to supply the increased fuel demanded by the metabolic workload for both the mother and the fetus.

(2) to spare protein for the added tissue building requirements. For these reasons, the mother must consider the nutrient and energy density of the food in her diet.

PROTEIN NEEDS

Protein serves as the building block for the tremendous growth of body tissues during pregnancy. Sufficient protein is required to meet the growth needs in the following ways:

1- A mature placenta requires sufficient protein for its complete development as a vital and unique organ to sustain, support, and nourish the fetus.

2- Growth of the fetus. The mere increase in size from one cell to millions of cells in a 3.2-kg (7-lb) infant in only 9 months indicates the relatively large amount of protein that is required for such rapid growth.

3- Growth of maternal tissues. To support pregnancy and lactation, the increased development of uterine and breast tissue is required.
4- Increased maternal blood volume. The mother's plasma volume increases by 40% to 50% during pregnancy. More circulating blood is necessary to nourish the fetus and to support the increased metabolic workload.
5- Amniotic fluid, which contains various proteins, surrounds the fetus during growth and guards it against shock or injury.

Food Sources

Complete protein foods of high biologic value include eggs, milk, beef, poultry, fish, pork, cheese, soy products, and other animal products (e.g., lamb, venison, and so on). Other incomplete proteins from plant sources such as legumes and grains contribute additional valuable amounts of amino acids. Protein-rich foods also contribute other nutrients, such as calcium, iron, zinc, and fat-soluble vitamins. The sample food plan in Table 10-1 demonstrates the amount of food from each food group recommended to supply the daily needed nutrients.

KEY MINERAL AND VITAMIN NEEDS

1- Calcium. A good supply of calcium—along with phosphorus, magnesium, and vitamin D-is essential for the fetal development of bones and teeth as well as for the mother's own body needs. Calcium is also necessary for blood clotting. A diet that includes at least 3 cups of milk or milk substitute daily (e.g., calcium-fortified soy milk), generous amounts of green vegetables, and enriched or whole grains usually supplies enough calcium.
2- Iron. Particular attention is given to iron intake during pregnancy. Iron is essential for the increased hemoglobin synthesis that is required for the greater maternal blood volume as well as for the baby's necessary prenatal storage of iron.
3- Folate. Folate is important for both mother and fetus throughout pregnancy. Tetrahydrofolic acid (TH4) participates in DNA synthesis, cell division, and hemoglobin synthesis. It is particularly relevant during the early periconceptional period (i.e., from approximately 2 months before conception to week 6 of gestation) to ensure adequate nutrient availability in the endometrial lining of the uterus for embryonic tissue development. The neural tube forms during the critical period from 21 to 28 days' gestation, and it grows into the mature infant's spinal column and its network of nerves.

4- Vitamin D. vitamin D deficiency is thought to be a common worldwide problem, including among pregnant women. There is concern that vitamin D deficiency during pregnancy may be associated with adverse outcomes for both the mother and the fetus, including preeclampsia, gestational diabetes, and preterm birth.

Table 10-1 Daily Food Plan for Pregnant Women*,†

	FIRST TRIMESTER 2200 KCAL	SECOND TRIMESTER 2400 KCAL	THIRD TRIMESTER 2600 KCAL
Grains‡	7 ounces	8 ounces	9 ounces
Vegetables§	3 cups	3 cups	3½ cups
Fruits	2 cups	2 cups	2 cups
Milk	3 cups	3 cups	3 cups
Meat and beans	6 ounces	6½ ounces	6½ ounces
Aim for at least this amount of whole grains per day	3½ ounces	4 ounces	4½ ounces
AIM FOR THIS MUCH WEEKLY			
Dark green vegetables	2 cups	2 cups	2½ cups
Red and orange vegetables	6 cups	6 cups	7 cups
Dry beans and peas	2 cups	2 cups	2½ cups
Starchy vegetables	6 cups	6 cups	7 cups
Other vegetables	5 cups	5 cups	5½ cups
OILS AND DISCRETIONARY CALORIES			
Aim for this amount of oils per day	6 teaspoons	7 teaspoons	8 teaspoons
Limit extras (extra fats and sugars) to this amount per day	266 calories	330 calories	362 calories

RISK FACTORS DURING PREGNANCY

• Anemia: low hemoglobin level (i.e., less than 12 g) or hematocrit level (i.e., less than 34%)

• Inadequate weight gain: any weight loss or weight gain of less than 1 kg (2 lb) per month after the first trimester

• Excessive weight gain: more than 1 kg (2 lb) per week after the first trimester.

• Substance abuse (i.e., alcohol, tobacco, drugs).

•Gestational diabetes, hypertensive disorder of pregnancy, hyperemesis gravidarum, pica, or another pregnancy related condition.

• Poor nutritional status, especially involving folic acid, iron, or calcium.

• Multifetal gestation.

LACTATION

Breastfeeding is "an unequalled way of providing ideal food for the healthy growth and development of infants. Breastfeeding is recommended for at least 1 year with iron-fortified solid foods added to the exclusive diet of breast milk at about 6 months of age.

Benefits of Breastfeeding Compared with Using Breast Milk Substitutes (i.e., Formula)

BENEFITS FOR INFANTS	BENEFITS FOR MOTHERS
• Optimal nutrition for infant	• Strong bonding with infant
• Strong bonding with mother	• Increased energy expenditure, which may lead to faster return to prepregnancy weight
• Safe, fresh milk	• Faster shrinking of the uterus
• Enhanced immune system	• Reduced postpartum bleeding
• Reduced risk for acute otitis media, nonspecific gastroenteritis, severe lower respiratory tract infections, and asthma	• Delayed return of the menstrual cycle
• Protection against allergies and intolerances	• Decreased risk for chronic diseases such as type 2 diabetes and breast and ovarian cancer
• Promotion of the correct development of the jaw and teeth	• Improved bone density and decreased risk for hip fracture
• Association with higher intelligence quotient and school performance through adolescence as a function of parental skill	• Decreased risk for postpartum depression; enhanced self-esteem in the maternal role
• Reduced risk for sudden infant death syndrome	• Time saved by not having to purchase, prepare, and mix formula
• Reduced risk for chronic diseases such as obesity, type 1 and 2 diabetes, heart disease, and childhood leukemia	• Money saved by not buying formula and from not having to pay the increased medical expenses associated with formula feeding
• Reduced risk for infant morbidity and mortality	

Nutrition during Infancy, Childhood and Adolescence

LIFE CYCLE GROWTH PATTERN

The normal human life cycle follows four general stages of overall growth, with individual variation along the way. The nutrition needs of an individual will depend more on the person's biologic age than his or her chronologic age**.** For example, if two infants were born yesterday and one infant was 6 weeks premature and the other infant was born at full term, they will both be 1 day old but will have different nutritional needs relative to their physiologic development

(i.e., their biologic age). The differences in nutrition needs, based on biologic age, are most important during key growth periods of life. Most notably, this is during infancy and the growth spurts surrounding puberty.

Biologic age: age of the body relative to physiologic and maturity developmental standards.

Chronologic age amount of time a person has lived.

Infancy

Growth is rapid during the first year of life, with the rate tapering off somewhat during the latter half of the year. Most infants more than double their birth weight by the time they are 6 months old, and they triple it by the time they reach about 12 to 15 months of age. Growth in length is not quite as rapid, but infants generally increase their birth length by 50% during the first year and double it by 4 years of age.

Weaning the process of gradually acclimating a young child to food other than the mother's milk or a breast milk substitute as the child's natural need to suckle wanes.

How Infants Learn to Eat?

Guided by reflexes and the gradual development of muscle control during their first year of life, infants learn many things about living in their particular environments.

A basic need is food, which infants obtain through a normal developmental sequence of feeding behaviors during the process of learning to eat.

1 TO 3 MONTHS

Rooting, sucking, and swallowing reflexes are present at birth in term infants, along with the tonic neck reflex. Infants secure their first food, milk, with a suckling pattern in which the tongue is projected during a swallow. In the beginning, head control is poor, but it develops by the third month of life.

4 TO 6 MONTHS

The early rooting and biting reflex fades. Infants now change from a suckling pattern with a protruded tongue to a mature and stronger suck with liquids, and a munching pattern begins. Infants are now able to grasp objects with a palmar grip, bring them to the mouth, and bite them.

7 TO 9 MONTHS

The gag reflex weakens as infants begin chewing solid foods. They develop a normal controlled gag along with control of the choking reflex. A mature munching increases their intake of solid foods while chewing with a rotary motion. These infants can sit alone, secure items, release and resecure them, and
hold a bottle alone. They begin to develop a pincer grasp to pick up small items between the thumb and forefinger and put the items into the mouth.

10 TO 12 MONTHS

Older infants can now reach for a spoon. They bite nipples, spoons, and crunchy foods; they can grasp a bottle or food and bring it to the mouth; and, with assistance, they can drink from a cup. These infants have tongue control to lick food morsels off of the lower lip, and they can finger-feed themselves with a refined pincer grasp. These normal developmental behaviors are the basis for the progressive pattern of introducing semisolid and table foods to older infants.

Childhood

Between infancy and adolescence, the childhood growth rate slows and becomes irregular. Growth occurs in small spurts during which children have increased appetites and eat accordingly. Appetites usually taper off during periodic plateaus. Parents who recognize the ebb and flow of normal growth patterns during the latent period of childhood can relax and enjoy this time. Alternatively, unawareness of or inexperience with this normal flux in growth and appetite can result in stress and battles over food between parents and children.

Adolescence

The onset of puberty begins the second stage of rapid growth, which continues until adult maturity. Levels of growth hormone and sex hormones rise, which brings multiple and often bewildering body changes to young adolescents. During this period, long bones grow quickly, sex characteristics develop, and fat and muscle mass increase significantly.

Adulthood

With physical maturity comes the final phase of a normal life cycle. Physical growth levels off during adulthood and then gradually declines during old age. However, mental and psychosocial development lasts a lifetime.

ENERGY NEEDS

The demand for energy as measured in kilocalories per kilogram (kg) of body weight per day (kcal/kg/d) is relatively large throughout infancy and childhood.

During the first 3 years of life, children need somewhere between 80 and 120 kcal/kg/d to support rapid growth. Although the exact energy needs of premature infants are highly variable and not well-defined, they are thought to range from 110 to 135 kcal/kg/d.

PROTEIN NEEDS

Protein is the fundamental tissue-building substance of the body. It supplies the essential amino acids for tissue growth and maintenance. As a child gets older and the growth rate slows, the protein requirements per kilogram of body weight gradually decline. For example, for the first 6 months of life, the protein requirements of an infant are 1.52 g/kg; however, the protein needs of a fully grown adult are only 0.8 g/kg. A healthy, active, growing child usually eats enough of a variety of foods to supply the necessary protein and kilocalories for overall growth.

WATER REQUIREMENTS

Water is an essential nutrient that is second only to oxygen for life. Metabolic needs, especially during periods of rapid growth, demand adequate fluid intake. Infants require more water per unit of body weight than adults for the following three important reasons: **(1)** a greater percentage of the infant's total body weight is composed of water; **(2)** a larger proportion of the infant's total body water is in the extracellular spaces; and **(3)** infants have a larger proportional body surface area and metabolic rate compared with adults. In 1 day, an infant generally consumes an amount of water that is equivalent to 10% to 15% of his or her body weight, whereas an adult consumes a daily amount that is equivalent to 2% to 4% of his or her body weight.

MINERAL AND VITAMIN NEEDS

All minerals and vitamins have important roles in tissue growth and maintenance as well as in overall energy metabolism. Positive childhood growth depends on adequate amounts of all essential substances. **Calcium** needs are critical during the most rapid growth periods of infancy through adolescence. During infancy, the mineralization of the skeleton is taking place while the bones are growing larger and

the teeth are forming. **Iron** is essential for hemoglobin formation and cognitive development during the early years of life. Infants of mothers with iron-deficiency anemia during gestation are at risk for iron-deficiency anemia at birth. Iron deficiency during this critical time of life is negatively associated with long-term cognitive and behavioral performance in children. The American Academy of Pediatrics recognizes only two vitamins that are potentially needed in supplemental form: Vitamins **K and D**. Nearly all infants who are born in the United States and Canada receive a one-time prophylactic injection of 1 mg of vitamin K at birth. Vitamin K is critical for blood clotting. A major contributor to the daily supply of vitamin K is provided by bacterial production in the gut. Because infants are born without bacterial flora, their vitamin K synthesis and stores are minimal.