Life Cycle Nutrition

Infancy , Childhood and Adolescence

Infancy and Early Childhood

Infancy, the first year of life, is a critical period for growth and development.

Growth is the progressive maturation and increase in size of a living thing. The only time humans grow faster than in infancy is the 40 weeks before they are born. An infant's birth weight should:

- Double by 4 to 6 months of age
- Triple by 1 year

From a birth length of about 20 inches, an infant grows to about 30 inches by age 1. An infant's rate of growth is more significant than absolute values. The growth charts on DavisPlus or at www.cdc.gov/growthcharts reflect growth patterns of all children in the United States. In 2006, the World Health Organization (WHO) released new standards for growth and development. The children measured for these standards were raised in an optimal environment (breastfed, nonsmoking home) for proper growth. The standards are applicable to all children regardless of ethnicity, socioeconomic status, or type of feeding. The WHO Child Growth Standards establishes that breastfed infants are the standard for measuring healthy growth, and previous growth charts utilized a combination of breastfed and artificially fed children. During the first few days after birth, an infant loses weight as he or she adjusts to his or her new environment and food supply. Among his or her adaptations is learning to feed compared with receiving a continuous supply of nutrients in utero. The amount of weight lost in these first few days should not exceed 7% of the birth weight The newborn or neonate, as an infant is called during the first 28 days after birth usually returns to its birth weight within 14 days. The period most critical to brain development extends from

conception into the second year of life. Brain cells increase most rapidly before birth and during the first 5 or 6 months after birth. To attain maximum brain growth, the infant needs optimal nutrition.

Psychosocial Development

American psychoanalyst **Erik Erikson** divided life into eight stages, each of which involves a psychosocial developmental task to be mastered and an opposite negative trait that emerges if the task is not mastered. Even if a developmental task is successfully mastered, anewsituation may arise, challenging the person to reaffirm his or her mastery.

Development

The gradual process of changing from a simple to a more complex organism is development. Becoming a mature individual involves psychosocial and physical changes, not only an increase in size. Psychosocial Development of the Infant The psychosocial developmental task of the infant is to learn to trust. The parent who responds promptly and lovingly to the infant's cries is teaching the infant to trust. If the caregiver handles the infant inconsistently—gently one time and roughly the next—however, the infant learns to mistrust. Failure to thrive (FTT) is a descriptive term used to describe inadequate growth or the inability to maintain growth A child may receive a diagnosis of FTT when his or her arc of growth slips by two major percentiles on a growth chart or when weight falls below the fifth percentile on multiple occasions. Inadequate caloric intake is the most common etiology associated with FTT and can be related to problems with feeding including poor sucking and swallowing, breastfeeding difficulties or difficulty transitioning to solid foods, insufficient breast milk or formula, excessive juice consumption, or caloric absorption problems. It can be helpful to assess caregiver–infant interactions related to feeding practices. In situations in which physical care is provided but a tender relationship does not develop, infants may actually suffer stunted physical growth. Caregiver education regarding feeding techniques, child cues and developmental stages can be helpful in addressing nonorganic causes of FTT

Nutritional Needs of the Term Infant

In general, infants' values are based on the contents of breast milk. In 2008, the American Academy of Pediatrics recommended that all infants receive a daily intake of 400 IU of vitamin D beginning in the first few days of life. A normal pregnancy is 38 to 42 weeks. An infant born after a

normal pregnancy is a **term infant**. Breast milk is the species-specific food for human infants. Its characteristics are the standard for infant formulas, which replicate many of the components of breast milk but cannot supply all of its desirable qualities.

Energy and Macronutrients

Resting metabolic rates of infants are high as evidenced by:

■ Normal pulse rate of 120 to 150 beats/min

■ Normal respiratory rate of 30 to 50 breaths/min

■ Large proportion of skin surface to body size requiring energy for temperature regulation An activity such as crying may double the infant's energy expenditure. Energy needs for the first 6 months of life are 108 kilocalories per kilogram of body weight per day. From 6 to 12 months of age, the energy need is 98 kilocalories per kilogram per day. Table 2 lists the macronutrients of special importance for infants with comparisons of the relevant components of breast milk and cow's milk. Clinical Application 11-1 discusses a carbohydrate source that.

Micronutrients

The general recommendations for vitamin and mineral supplementation in infants are listed in(Table 2). Despite the recommendation by the American Academy of Pediatrics to supplement breastfed infants with vitamin D, only 36.4% of pediatricians surveyed did so. Among parents of predominantly breastfed infants who indicated that their child's doctor recommended vitamin D, just 44.6% gave the supplement to their child

VITAMINS

The routine administration of vitamin K to all infants is mandatory. Infants are at a higher risk for hemorrhagic disease due to lack of vitamin K transfer across the placenta, low levels in breast milk, immature liver, and low bacterial production in the colon. Vitamin K deficiencies can result in Vitamin K deficiency bleeding with 50% of infants presenting with intracranial hemorrhage

MINERALS

Compared with cow's milk, breast milk contains:

■ One-third the sodium, potassium, and chloride

■ One-eighth the phosphorus of cow's milk, an amount that accommodates the limited function of the infant's kidneys

TABLE 11-3 ■ Macronutrient Needs of Term Infant

	NUTRIENT NEEDED	BREAST MILK	COW'S MILK	CONTRAINDICATIONS
Carbohydrate	Galactose is necessary for brain cell formation.	Breast milk contains amylase that is 40–60 times more active than that of cow's milk.		Honey (Clinical Application 11-1)
Fat	Fat and cholesterol are necessary for rapidly growing brain and nervous system, bile, and hormones.	Provides 55% of kilocalories from fat as concentrated energy source. Contains lipase to begin digestion for the infant so about 95%–98% of the fat in human milk is absorbed.		Reduced-fat milks before age 2
	The developing nervous system needs arachidonic and docosahexaenoic (DHA) fatty acids, the main omega-6 and omega-3 fatty acids of the central nervous system.	These two fatty acids, essential for retinal and neural development are found in human milk.	Not present	
Protein		Human milk contains 70% whey (easily digested) and 30% casein. The major whey protein in breast milk is alpha-lactalbumin, with an amino acid pattern much like that of the body tissues.	18% whey, 82% casein	

Adapted from Brown (2008); Rioux, Belanger-Plourde, LeBlanc, & Vigneau (2011); Schwartz, Drossard, Dube (2010); Xavier, Rai, K., & Hedge (2011).

compared with other countries, they are still low. Benefits of breastfeeding include:

■ Breastfed infants have been shown to have decreased rates of otitis media, respiratory

Composition of Breast Milk

Breast milk accommodates the infant's needs during the weeks an infant is nursing, even during the course of a single feeding. Breast milk varies from mother to mother and even in one mother with the time of day. It also varies with the lactation cycle. The variation in content also offers the infant a variety of taste experiences .

Unique Advantages of Breastfeeding

One well-documented advantage to breastfeeding thathas not been duplicated by formulas is protectionagainst infectious disease. Other advantages are limitedimprovement in the presentation of allergic disease and a possible negative association with obesity.

PROTECTION AGAINST DISEASE

In both developing and industrialized countries, breastfeedingreduces the incidence of gastrointestinal andrespiratory diseases and otitis media (middle ear infection).Any breastfeeding is associated with a reductionin gastrointestinal tract infections, whereas the developmentof lower respiratory tract infections and otitis media is reduced

ininfants who exclusively breastfeedfor more than 4 months (Breastfeeding, 2012). Studies have also demonstrated any amount of formula feedingsignificantly increases the infant's risk of developingotitis media (McNeil, Labbok, and Abrahams, 2010).
Breast milk contains bioactive components that protect the infant from disease by:

- Transfer of passive immunity from mother to infant.
- Antioxidant activity of human milk.

Among the infection-fighting agents in breast milkare immunoglobulin (Ig)A and leukocytes or white blood cells (WBCs) .

The Formula-Fed Infant

As good as it is, exclusive breastfeeding is not possiblefor all mothers and infants. Infant formula is the onlyfood that is regulated by its own law, the Infant Formula Act of 1980, which sets minimum levels of 29 nutrientsand maximal levels of 9 nutrients. Formulas for fullterminfants must contain 20 kilocalories per ounce. As much as possible, commercial formulas are designed tomatch the qualities of human breast milk.Formulas contain more protein than breast milk.The cow's milk proteins do not contain the optimalamino acids for human infants. Enough protein is includedin the formula to provide a sufficient distributionof amino acids.
The saturated fats of cow's milk are poorly digestedby the infant. In formulas, vegetable oils replace thesaturated fats.

Formula Preparations

Commercial formulas come in three forms: powder (tomix with water), liquid concentrate, and ready-to-feed.Directions for preparing the formula will be given by the health-care provider. Commonly discussed issues include:

- Cleanliness/sterility of equipment
- Water to use for dilution:
- Sterility
- Fluoride content
- Possible lead contamination
- Safe storage
- Use of correct strength formula (Formula too concentratedor too dilute can cause severe electrolyteim balances. Some cases have been fatal).

Feeding Techniques

Approximately every 4 hours, the infant awakens forfeedings. By the age of 2 to 3 months, the baby probably will have eliminated one feeding, so the schedule is five times a day. By 6 months, most infants are feeding four times a day.
The baby is positioned in the crook of the arm, almost as if breastfeeding. The parent's or caregiver'stouch is important to the infant's development. Correct techniques include the following:

■ The nipple holes should be large enough for milk todrip out on its own without shaking the bottle.
■ The nipple should always be filled with milk to preventthe infant from swallowing air while feeding.
■ Daily formula intake for an infant should be 1.5 to2 ounces per pound of body weight, but growth is abetter measure of health than the amount of formulaswallowed.
■ A single feeding should not exceed 8 ounces.Propping an infant with a bottle is never acceptablebecause choking is a real hazard.

Hazards of Formula Feeding

On a few occasions, improperly manufactured formulashave been responsible for vitamin and mineral deficienciesin infants. This is an unacceptable, but fortunately rare, occurrence. A more common hazard,and one an individual nurse can monitor, is the improperpreparation and use of formulas by the parent.
Formulas can be:
■ The wrong strength
■ Prepared with contaminated water, equipment, orhands
■ Kept at feeding temperature too long. Body temperatureis "just right" for bacteria to multiply, whetherin the body or in a formula bottle.

Nutrition of the Toddler (Ages 1 to 3 Years)

The child's nutritional needs become more like thoseof adults after the first birthday. During the toddler years, growth is slower than during infancy, and although activity increases, the proportional need forkilocalories decreases compared with infancy. Thus, the child's appetite slackens.How and what the family eats will influence the child'shabits and tastes for many years. Being forced to eat adistasteful food because "it's good for you" has imprinted permanent avoidance behaviors on some individuals.Conversely, some parents expand their repertory ofmenu choices to set good examples for their children.

Psychosocial Development

Autonomy or independence is the psychosocial developmental task of the toddler. Every 2-year-old knows the word *no.* One way parents can assist a toddler achieve autonomy is to encourage choices from acceptablefood alternatives. If parents insist that a child eat certain items or amounts, the child may learn to use food rejection as a means of gaining attention. Later, more serious eating problems may resultfrom such interactions. The parent can, however, create structure in the child's day by insisting the child remain at the table during mealtime whether or not items are consumed.

Physical Growth and Development

During the toddler years, growth slows. The expected weight gain in the second year may be just 4 to 6 pounds. Height may increase by about 4 inches. By age 2, however, head circumference reaches two-thirds of its adult size. *See "Growth Charts" on DavisPlus or at www.cdc.gov/growthcharts.*The toddler is aptly named. One of the skills acquired during this time is walking upright. As this skill is being perfected, the child's muscles of the back, buttocks, and thighs are enlarging. The bones are becoming more mineralized, and "baby fat" is disappearing. Along with the grossmotor skill of walking, the toddler's fine motor control improves. He or she is able touse eating utensils with more finesse. The spoon is likely to reach the mouth still filled with food. The toddler's mouth is more sensitive than an adult's mouth. Foods are eaten better at lukewarm temperatures rather than hot. Thus, dawdling at the table may have a physiological basis.

Nutrient Needs and Intake

For DRIs, see Appendix A. In 2008, the American Academy of Pediatricsrecommended that all children receive a daily intake of 400 IU of vitamin D, The need for manynutrients increases proportionately with body size throughout the growth years. These needs, coupled with the toddler's poorer appetite, stretch parents' ingenuity andpatience. According to the American Academy of Pediatrics, despite the toddler's poorer appetite, vitamin supplements are probably unnecessary for healthy childrenolder than 1 year. Special circumstancesmay indicate a need for supplementation.

Food Likes

Toddlers like finger foods and can learn about textureby eating them. Toddlers prefer plain foods to mostmixtures such as casseroles. Familiar combinations, such as macaroni and cheese, spaghetti, and pizza, however, may be relished. Unfamiliar foods that arerejected the first time should be offered again at a later time.

Nutrition of the Preschool Child (Ages 3 to 6 Years)

This is a delightful time of enthusiastic learning, including
food preferences.

Psychosocial Development

Initiative is the psychosocial task to be mastered by the preschool child. Within their capabilities, children should be encouraged to set and achieve some goals of their own. Children can participate in planning and preparation of meals, and they should help in the kitchen, not just with cleanup. Preschool children can make gelatin desserts, fancy cookies, and showy relishes to foster a sense of accomplishment.By making the meal a social time and eating slowly themselves, parents can encourage the same behavior in a child. Exemplifying good manners will be more productive than criticizing the child's manners. Having company their own age is helpful. Children stay at the table longer and eat more in the company of their peers.

Exchanging visits with a friend's child will begin to broaden the child's horizons.

Nutrient Needs and Intake

For DRIs, see Appendix A. In 2008, the American Academy of Pediatrics recommended that all children receive a daily intakeof 400 IU of vitamin D More than 30% of children in the United States take dietary supplements regularly, most often multivitamins and multiminerals. Supplement use was associated with higher family income, a smoke-free environment, not participating in the Women, Infants, and Children program (WIC), lower child body mass index (BMI), and less daily television and computer use time Preschool children are very active. A 3-year-old may need 1300 to 1500 kilocalories per day. Serving sizes for 4- to 6-year-old children are the same as those recommended for adults.

Nutrition of the School-Age Child (Ages 6 to 12 Years)

A balanced diet suitable for healthy adults will also be good for a school-age child. Diets should not be restricted because of the energy (kilocalorie), fat, or sugar content of any one food, nor should foods be labeled good or bad. In the first case, food may be regarded as medicine, and in the second, as "forbidden fruit." Neither viewpoint fosters positive attitudes.

Psychosocial Development

According to Erikson, the developmental task of the school-age child is **industry.** The school years are the years to build competence in many different skills. Making and keeping commitments is part of developing industry. School-age children canparticipate in planning menus, shopping for food, preparing the meals, as well as cleaning up afterward .Limiting the child's role to washing the dishes or taking out the garbage will be more likely to foster a sense of inferiority than habits of industry.

Physical Growth and Development

The average yearly growth during the school years is 7 pounds and 2.5 inches. The growth is not evenly distributed throughout the year, reflected in an inconsistentappetite. A child's progress should be tracked on the CDC growth charts to determine if growth iswithin the normal range. Exercise can help the school-age child's growth and development by stimulating osteoblasts and expending energy to control weight. Activities that are likely to become lifetime interests should be especially encouraged. Unlike sports such as football that are played by few adults, tennis or similar skill sports may provide an outlet for a lifetime. By school age, the effects of good or poor nutrition will begin to be apparent.

Nutritional Needs and Concerns

For DRIs, see Appendix A. In 2008, the American Academy of Pediatrics recommended that all children receive a daily intake of 400 IU of vitamin D (Minarich and Silverstein, 2011).

Meal Patterns and Behaviors

A school-age child cannot consume all the needed nutrients in three child-sized meals. Healthy snacks are necessary to complement the main meals. Likewise, breakfast is essential and should contain one-fourth to one-third of the day's nutrients. Skipping breakfast has been shown to lead to consumption of higher-fat snacks later in the day, resulting in higher BMI .School-age children are generally so active that they may have trouble sitting still. Requiring them to spend 15 to 20 minutes at the table for meals will increase the likelihood that they will eat a complete meal. Concerning attention-deficit/hyperactivity disorder, studies are showing that a balanced diet high in omega-3 fatty acids and free of potential allergens, food preservatives, and high amounts of processed sugars may be a beneficial strategy used in the treatment of the disorder .Further research is being conducted. One study showed that eating five to seven family dinners per week resulted in significantly higher frequency of breakfast consumption and higher daily servings of fruits, and those who did not report eating family dinners were three times more likely to be overweight.
and six times more likely to be food insecure. Another studyshowed that females aged 9 to 14 years who ate family dinner most days of the week were less likely to initiate purging, binge eating, and frequent dieting .

Nutrition at School

Nutrition education continues in school, focusing on foods, not nutrients. Interactions with other children and school experiences expose a child to new foods and different cultures. One study looked at the use of the Nutrition Detective program, which educates students on the selection of healthful foods that are minimally processed, low in added sugars and trans-fats, and rich in desirable constituents, such as fiber. The study showed that the program enhanced the ability of both students and their parents to distinguish more healthful from less healthful options Because children need nourishment to learn and many come to school hungry, food assistance is available at school. Federally reimbursable school meals programs require participating schools to offer meals free or at reduced prices to eligible children. In 2011, 12.1 million children participated in the School Breakfast Program, and 10.1 million received their meals free or at a reduced price.

Nutrition in Adolescence

Adolescence is the period that extends from the onset of **puberty** until full growth is reached. For most individuals, adolescence occurs between the ages of 12 and 20. Adolescence is second only to infancy in the nutritional requirements necessary for

growth and development.Unfortunately, most adolescents do not meet the daily recommendation for fruits, vegetables, and whole grains; they exceed the daily recommended amount of sodium; and they drink more full-caloriesoda per day than milk information regarding energy drinks and the adolescent.

Psychosocial Development

Achieving their own **identity** is the developmental task Erikson identified for adolescents, including accepting their capabilities. In this process, teenagers "try on" various identities. Adolescents pick up fads instantly and drop them just as suddenly. Food and eating fads are part of the same pattern.

Physical Growth and Development

The term *growth spurt* is accurate. Boys and girls differ in the timing and completion of the growth spurt To track an adolescent's growth, BMI-for-age percentile charts (2- to 20-year-old boys and girls) are available on *DavisPlus or at www.cdc.gov/ growthcharts.*
Approximately 90% or more of adult mass is obtained during childhood and puberty The peak growth spurt is.

Nutritional Needs and Concerns
Calcium and Iron

Regarding nutrients, adolescent diets are lacking in calcium and iron. Long term, deficiencies of those minerals may be manifested in osteoporosis or anemia.Short term, evidence suggests an influence of dietary factors on fracture occurrence. Although rates of fracture vary considerably with age, sex, and maturation, they peak in early puberty. At that time, rates of bone turnover are high, but bone mineral accrual lags behind gains in height and weight. Among the factors impacting pediatric fracture incidence are the following:

- Bone mass and bone mineral density
- Low calcium intake
- High body mass index
- Excessive consumption of carbonated beverages
- Lack of weight-bearing physical activity

Energy drinks are beverages that contain higher levels of caffeine than soda and also can contain herbal supplements and vitamins. Energy drinks market the effects of improved energy, reaction time, and improved concentration, which are attractive benefits to some adolescents. There is an increase in energy drink consumption among adolescents in recent years. One study demonstrated that 31% of 12- to 17-year olds reported regular consumption of energy drinks. Adolescents may not be

educated on the differences between sports drinks and energy drinks, and use of energy drinks before and during exercise can contribute to dehydration, tremors, heat stroke, and heart attacks.Adolescents with preexisting conditions or undiagnosed conditions such as heart disease are at increased risk when consuming energy drinks. Education needs to be provided to adolescents while further research is conducted to determine the safety of energy drinks in adolescentst

Carbohydrates: 45% to 65% of daily calories
Protein: 10% to 30% of daily calories
Fat: 25% to 35% of daily calories
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they peak in early puberty. At that time, rates of bone turnover are high, but bone mineral accrual lags behind gains in height and weight. Among the factors impacting pediatric fracture incidence are the following:

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Overenthusiastic Weight Control

Because of the cultural value placed on thinness, adolescents, especially girls, may restrict their dietary intake to achieve a desired slim body. Some use unhealthy practices such as fasting, diet pills, laxatives, and vomiting to remain slim. **Anorexia nervosa** affects 0.5% to 1% of 14- to 18-year-old girls and is covered in Chapter 16. Eating disorders can last for years, with consequences related to growth and development. Participating in sports that value slimness is a risk factor for both girls and boys . One study demonstrated a total of 10% to 15% of boys who participated in weight-sensitive sports, such as wrestling, practice unhealthy weight loss behaviors. Some adolescents may adopt vegetarianism as ameans to control weight and body shape rather than for ecological or spiritual reasons. Regardless of the reason they have become vegetarians, these adolescents should have their nutritional status and dietary intake monitored.

Acne and Diet

Acne afflicts more than 17 million Americans with approximately 80% to 90% of adolescents affected. Acne is triggered by sex hormones stimulating the sebaceous glands. The skin becomes oilier and the ducts to the glands sometimes plug up, permitting the accumulation of harmful bacteria that produce inflammation. The sebaceous glands' production of sebum may be
influenced by androgens and hormonal mediators that, in turn, may be stimulated by foods. Dietary components that have recently been revisited regarding acne are dairy products, high glycemic index foods, fat intake, and fatty acid composition. On the one hand, some experts conclude that no clear proof exists as to whether culprit foods

such as dairy products, chocolate, and fatty foods affect acne. Others are convinced that dairy products and high glycemic index foods influence hormonal and inflammatory factors thus increasing acne prevalence and severity. The suggested link to dairy foods speculates that milk contains hormones and bioactive molecules.
Another theory is that hyperinsulinemia initiates an endocrine sequence, resulting in increased androgens and an altered retinoid signaling pathway related to acne. Recent trials have demonstrated decreased acne after 12 weeks on a low glycemic load diet.
Foods with a high glycemic load, such as white bread or potatoes, cause a rapid rise in blood glucose. Foods with a low glycemic index, such as high-fiber cereals or beans, cause a more gradual change in blood glucose. Recent evidence has identified that reactive oxygen species, free radicals, and oxidative stress play a role
in initiating acne, and antioxidant vitamins like A andE are lower in clients who have acne.

Overweight in Children and Adolescents

Obesity in children and adolescents has become a national epidemic and is projected to worsen over time Childhood overweight and obesity rates have doubled in the past three decades, whereas theoverweight and obesity rates of adolescents have tripled.
Those who are overweight or obese have a higher risk of developing:

- Type 2 diabetes
- Hypertension
- Negative self-image associated with psychosocial issues

More than 60% of children who are overweight before puberty will be overweight in adulthood . Some of the factors contributing to overweight and obesity in children are:

- Unwise food choices
- Inactivity, with television and computer games replacing active play
- Decreased ability to self-regulate energy intake related to overcontrolling parents
- Inability of parents to see child as overweight
- Failure of health professionals to prioritize the diagnosis of obesity compared to other health risks
- Genetics

These approaches cost less than treatment of established obesity and reach the greatest number of children. Overweight children require careful supervision to maintain normal growth and development while reducing weight and adipose tissue. Treatment of obese children requires a multicomponent program encompassing diet, physical activity, nutrition counseling, and parent or caregiver participation.
The conditions permitting or encouraging overweight among youth have evolved over many years and have become embedded in the dominant culture that involves the food industry and marketing. No single change is going to reverse the trend. Multiple interventions and strategies are needed at all levels: individuals, families, schools, communities, and the nation.