

Chapter 3

Young Children: Preparing for the Future

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Key Points

- A carefully chosen diet can provide the energy and nutrients that children need to grow, learn, and play.
- The Centers for Disease Control and Prevention (2000) growth charts are typically used to monitor growth.
- The Dietary Guidelines for Americans and the MyPlate resource are appropriate tools to support healthy food choices for children.
- Childhood overweight is a multifactorial problem which requires a very broad approach, including diet, physical activity, psychological support, behavior modification, and caretaker involvement.
- Food insecurity, iron-deficiency anemia, and food allergies are all issues which may affect dietary quality and may require referrals to registered dietitians or food assistance programs.
- Nutritional and vitamin supplements are not necessary for well-nourished children.

Keywords Children • Growth charts • Child obesity • Dietary guidance • Physical activity • Food allergies • Iron-deficiency anemia • Food insecurity

Introduction

Early childhood nutrition is essential for growth and development and can establish dietary habits that last into adulthood. It is important for children to receive a balanced diet that provides a variety of foods in order to ensure that their energy and nutrient intake are adequate. Parents and caregivers play an important role in modeling healthy eating behaviors, and care should be given to delineate the role of the adult and that of the child during mealtime [1]. Poor nutrition in childhood can increase the risk of illness and obesity and can affect intellectual and physical capacities [2].

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Monitoring Growth

The Centers for Disease Control and Prevention [3] recommends that healthcare providers in the United States use the World Health Organization (WHO) growth standards to monitor the growth of children under 2 years of age and the CDC growth charts for children age 2 years and older [3]. Children under 2 years should be weighed without clothes or diapers and measured in a recumbent position. Children over the age of 2 should be weighed and measured in light clothing without shoes, standing for measure of stature. The growth charts plot trends in weight for age, height for age, head circumference for age, weight for height, and body mass index (BMI) for age. Trends for these measures should be monitored and can be used to determine whether there is an indication of nutritional risk [4]. It is important to note that single data points should not be used, but, rather, trends should be monitored, and other factors, such as gestational age, chronic illness, and the biological parents' stature, should also be taken into account [4].

BMI is measured in children over the age of 2 years and can be used as a screening tool to determine underweight, overweight, or obesity; however, it is not a diagnostic tool, and additional assessment is necessary to evaluate the child [5]. A BMI below the 5th percentile for age indicates underweight, between the 85th and the 95th percentile indicates overweight, while a BMI greater than the 95th percentile indicates obesity [4].

Nutrition Guidance

Energy and Nutrient Needs

Total estimated energy requirements are based on the age, weight, height, sex, and level of physical activity. Table 3.1 states the estimated energy requirements for different age and gender groups. The table also states the Recommended Dietary Allowance amounts and Adequate Intakes for selected nutrients. Requirements for energy and most nutrients steadily rise with age.

A diet rich in fiber provided by fresh fruits and vegetables, whole grains, and legumes is essential for preventing constipation [7]. Several studies have indicated that a diet rich in fiber is also associated with better nutrient intake, reduced risk of obesity, and better cognitive function in children [8–10]. These improved health outcomes are associated with the fact that whole grains and legumes are excellent sources of fiber, protein, B vitamins, and minerals including potassium and magnesium [11]. The USDA 2015–2020 Dietary Guidelines now recommend that fiber intake is 14 g/1000 kcal. For children this can range from approximately 14 to 20 g/day [12].

Table 3.1 Recommended dietary allowance (RDA) and adequate intake (AI) for selected nutrients in childhood based on the estimated energy requirements (EER) for age, weight, height, and sex at a sedentary level of activity

Gender and age (year)	EER energy (kcal/day)	RDA protein (g/day)	AI fiber (g/day)	RDA iron (mg/day)	AI calcium (mg/day)	RDA vit D (IU/day)
Male (1–3)	1000	13	14	7	700	600
Male (4–8)	1400	19	19.6	10	1000	600
Male (9–13)	1800	34	25.2	8	1300	600
Female (1–3)	1000	13	14	7	700	600
Female (4–8)	1200	19	16.8	10	1000	600
Female (9–13)	1600	34	22.4	8	1300	600

Source: Institute of Medicine [6]

Fluids in the diet should be provided primarily by water and milk. Children should be offered approximately 500 mL of milk or a fortified soy beverage a day [13, 14]. This provides several micro-nutrients including calcium, vitamin D, and protein. Fluid requirements can be calculated based on the weight of the child, calculating 100 mL of fluid/kg of body weight under 10 kg (22 lb), and adding 50 mL/kg up to 20 kg (44 lb), and another 20 mL/kg above 20 kg [13, 14]. The requirement for fluid is increased with physical activity, fever, vomiting, diarrhea, and other medical conditions as well as hot, dry, or humid weather.

Sugar-sweetened beverages, including soft drinks and artificial fruit beverages, are an increasing concern in children's diets. Evidence suggests that consumption of these beverages is associated with overweight and obesity in children, as well as increased dental caries [15–17]. The WHO [16] recommends limiting sugars added to food and beverages, as well as those naturally occurring in fruit juice, honey, and other syrups to less than 10% of total energy intake. Much the same recommendation is made in the USDA 2015–2020 Dietary Guidelines. Parents should be encouraged to offer children water or milk when they are thirsty and to limit other beverages offered.

Children consuming a diet in compliance with the Dietary Guidelines for Americans (see below) are likely to consume adequate amounts of vitamins and minerals. However, iron, calcium, and vitamin D intakes are often below the RDA in the diets of children. Dietary strategies for increasing iron intake and absorption include limiting milk or soy beverage intake to less than 750 mL/day, consuming meat and meat alternatives with a source of vitamin C to increase absorption, and including fortified breakfast cereals in the diet. Calcium can inhibit iron absorption; calcium-rich products should therefore be consumed at a different time than foods containing iron.

If calcium intake is a concern, intake can be increased by offering a variety of low-fat dairy products and calcium-fortified foods such as cereal. Children who do not consume 500 mL of milk or fortified alternative a day should be given a supplement that supplies 400 IU of vitamin D a day in order to ensure adequate intake [18].

Dietary Guidance

The Dietary Guidelines for Americans are applicable for children aged 2 years and above [19]. The recommendations include:

- Half of all grains consumed should be whole grains
- For children aged 2–3 years, fat should comprise 30–40% of calories and for older children fat intake should be reduced to 25–35% of calories, primarily from unsaturated fats.

The fat content of the diet should be provided by whole foods and should come primarily from monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs), such as those found in fish, nuts, and seeds.

The MyPlate Daily Checklist can be personalized for children and adolescents by entering their age, sex, and physical activity level. The USDA also offers Supertracker that can provide a personalized plan based on age, sex, physical activity level, height, and weight. Following the personalized recommendations can help children meet their energy and nutrient needs and encourage physical activity.

Recommendations for exercise are also of major importance, including:

- Children age 1–4 should engage in at least 180 min of activity per day
- Children age 5–11 should do at least 60 min of energetic play per day [20].

Healthy Eating Behaviors

As children enter their toddler years, the rate of growth slows and there is a corresponding decrease in appetite. This can be a great source of worry to parents who may become overwhelmed with the task of achieving nutritional recommendations with a toddler who has suddenly become less interested in food.

This decrease in appetite coincides with developmental stages in which asserting independence and establishing self-control are central to the child. Evidence shows that the more pressure parents use to coerce their children to eat or to try new foods, the less likely they are to succeed [21]. Likewise, being overly restrictive about certain foods can increase the desirability of those foods. Parental tactics regarding food intake (e.g., requiring that a child “clean their plate”) can diminish the child’s internal cues about hunger and satiety, leading to a decreased capacity for food self-regulation [22]. Research is still limited on the effect of parental feeding and childhood weight; however, pressuring children to eat has been associated with increased fussiness and food refusal [21, 23].

Ellyn Satter’s work on eating competence recommends a division of parental and child responsibility. It is the parent’s responsibility to offer a variety of healthy foods at meals and snacks, and the child’s responsibility to decide how much they will eat, and even whether they will eat at all. Research by Fildes et al. [24] has shown that exposure to a variety of foods in infancy can increase acceptance in toddler years, and it is established that children with repeated exposure to different foods have increased acceptance of those foods [25].

The following suggestions may help to encourage children to eat a variety of healthy foods:

- Eat regular mealtimes together as a family as much as possible. Mealtimes should be social and pleasant, not a time for television, arguing, or conducting work.
- Model good food choices; do not expect children to eat a better diet than their parents.
- Discourage “grazing” throughout the day. Rather, offer three meals and two or three snacks each day, giving the child a chance to build up an appetite between eating occasions.
- Snacks should be chosen from the major food groups, i.e., whole grains, fresh fruits and vegetables, dairy, and protein-rich foods.
- Children should be seated and supervised any time that they eat.
- Encourage children to participate in food selection at the grocery store, food preparation, and serving of the meal.
- Serve appropriate portion sizes. A reasonable portion size for children up to 2 years of age is one to two tablespoons. For children up to 4 years, portion sizes are about two-thirds the size of adult portions.
- Be tolerant of infant and toddler-feeding skills. Self-feeding and food exploration allows the child to become familiar with new tastes and textures.
- Serve new foods in small portions, along with familiar foods, at the beginning of the meal when the child is hungry. A new food may need to be offered up to 15 times before it is accepted.
- Offer a variety of foods from infancy onwards.
- Never force a child to eat.
- Avoid using food as a reward, and never withhold food as a punishment.

Nutrition Concerns During Childhood

Childhood Obesity

The prevalence of overweight in children has been rising steadily over the past three decades. According to CDC data for 2014, 10.2% of children aged 2–5 and 17.9% of those aged 6–11 are overweight, defined as a BMI for age greater than the 95th percentile [26]. Besides the social and

emotional problems associated with overweight, these children are also at higher risk for chronic diseases, including hypertension, the beginnings of atherosclerosis, and type 2 diabetes [27].

The causes of overweight are multifactorial, and approaches for prevention and treatment must address not only diet and physical activity but also psychological support, behavior modification, and caretaker involvement. The goal of treatment is to slow the rate of weight gain and allow growth in height to catch up to weight. In children with severe overweight, moderate weight loss may be advised but should be overseen by a physician and registered dietitian. When calories are restricted, it becomes more difficult to achieve sufficient intake of vitamins and minerals; nutrient-dense foods must therefore be emphasized.

Parents should be encouraged to follow the suggestions outlined above for improving intake of a variety of healthy foods. In addition, three factors have a pronounced impact on overweight in children: physical activity, consumption of sugar-sweetened beverages, and television viewing.

The importance of exercise for children was emphasized above. Children should be encouraged to go outside, participate in sports, and engage in active play throughout the day. Sedentary activities, such as screen time, video games, sitting in a stroller, and being in a car, can contribute to overweight and obesity in children. Sedentary activities that use very little energy above basal metabolic rates, and time spent viewing television replaces physical activity in the daily schedules of children. Screen time should be avoided in children under two, limited to an hour or less in children 2–4, and limited to 2 h or less in children 5–11 [19]. Screen time can also contribute to exposure to food advertising and encourage mindless snacking.

Sugar-sweetened beverages have been shown to be a significant factor in the development of obesity in children [15, 27]. These beverages, including soft drinks and artificially sweetened fruit beverages, offer little or nothing in the way of nutrition and should be offered in child-sized portions on special occasions; they are not appropriate for daily use.

Food Insecurity

An estimated 20% of American children aged under age 17 live in households that are food insecure, that is, households in which there is no access at all times to enough food for active, healthy lives for all family members [28]. Characteristics of households more likely to be food insecure include: incomes below the poverty level; education of parents less than high school diploma; headed by a single mother; and black, Hispanic descent, or American Indian/Alaska Native descent. Chronic food insecurity can result in poor nutrition, poor academic performance, and behavioral problems. Children from low-income, food-insecure households are at increased risk of iron-deficiency anemia (see below). Children from food-insecure households should be referred for food assistance programs such as the National School Lunch and Breakfast Programs, Food Stamps, and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Food Allergies and Sensitivities

True food allergies involve an antibody response to large molecules in the blood; therefore, the only way to make a diagnosis is to test for antibodies. The foods that most commonly cause allergies are peanuts, tree nuts, milk, eggs, wheat, soybeans, fish, and shellfish, with peanuts being the most common. Children may outgrow allergies to milk, eggs, and soy. When a true food allergy is present, the only remedy is strict avoidance of the food. Children with food allergies must be taught skills to

recognize and refuse foods to which they are allergic and to recognize symptoms of an allergic attack, such as tingling of the mouth and throat. Children who have serious food allergies should carry a supply of epinephrine in case of accidental ingestion of the offending food. If whole food groups, such as dairy, must be eliminated, a dietitian should work with the family to ensure that all nutrient needs are met. See Chap. 17 for more about food allergies.

In contrast, children with food sensitivities or intolerances may experience symptoms, including nausea, vomiting, headache, or hives, but without an antibody response. Foods that are commonly implicated in intolerances include monosodium glutamate (MSG) and lactose-containing dairy products.

Iron-Deficiency Anemia

In the United States, 3.4% of children between birth and age 5 years have iron-deficiency anemia, and this number increases up to 64% in Africa [29]. Low-income children are at greater risk [29]. Studies have shown associations between iron-deficiency anemia and poor motor and mental development [30]. Strategies to increase iron intake were discussed earlier. When dietary measures to increase iron intake do not resolve the problem, iron supplements may be necessary. If iron deficiency is suspected, it is important to evaluate serum markers before suggesting iron supplementation.

Vitamin and Mineral Supplementation

When children consume a carefully selected nutrient-dense diet, vitamin and mineral supplements are not necessary. Some children may benefit from iron or vitamin D supplementation, as noted above. When supplements are given, parents should be cautioned to use a brand that is specifically formulated for children and to make sure that the doses given do not exceed the tolerable upper intake for the child's age/weight. Care must be taken to keep iron supplements out of children's reach as iron from supplements is a major cause of poisoning in children. Herbal supplements are not tested for safety in children and are therefore not recommended.

Conclusion

Childhood nutrition has a major impact on growth and development. It also affects health outcomes and habits much later in life. It is therefore important to ensure that children are offered a variety of nutrient-rich unprocessed foods early on. Energy-dense foods, such as refined carbohydrates and sugar-sweetened beverages, should be limited as they displace nutrients and can lead to adverse health outcomes. Furthermore, developing healthy eating habits is also important, and parents/caregivers should be encouraged to practice Ellyn Satter's division of responsibility, where "parents are responsible for deciding *what*, and children are responsible for deciding *how much*" [31]. In addition to a healthy diet, children should also be encouraged to play and engage in physical activity every day, and television viewing should be limited. Ultimately, parents/caregivers should act as role models and should model healthy living behaviors for their children.

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