

Pediatric Weight Management

Second Edition

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*Academy of Nutrition and Dietetics Pocket Guide to
Pediatric Weight Management, Second Edition*

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Frequently Used Abbreviations

ALT	alanine aminotransferase
AST	aspartate aminotransferase
BMI	body mass index
CDC	Centers for Disease Control and Prevention
DRI	dietary reference intake
eNCPT	electronic Nutrition Care Process Terminology
FDA	US Food and Drug Administration
HIPAA	Health Insurance Portability and Accountability Act
MNT	medical nutrition therapy
NAFLD	nonalcoholic fatty liver disease
NCP	Nutrition Care Process
NCPT	Nutrition Care Process Terminology
NHANES	National Health and Nutrition Examination Survey
NHLBI	National Heart, Lung, and Blood Institute
PA	physical activity
PAL	physical activity level
PES	problem, etiology, and signs and symptoms
PWM NPG	Pediatric Weight Management Nutrition Practice Guideline
RDN	registered dietitian nutritionist
TEE	total energy expenditure
WHO	World Health Organization

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Academy of Nutrition and Dietetics Evidence Analysis Ratings

The following ratings are used in Academy of Nutrition and Dietetics evidence analysis projects, including the Evidence-Based Pediatric Weight Management Nutrition Practice Guideline.

Strong

Definition

A **Strong** recommendation means that the work group believes that the benefits of the recommended approach clearly exceed the harms (or that the harms clearly exceed the benefits in the case of a strong negative recommendation) and that the quality of the supporting evidence is excellent/good (grade I or II). In some clearly identified circumstances, Strong recommendations may be made based on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.

Implication for Practice

Practitioners should follow a **Strong** recommendation unless a clear and compelling rationale for an alternative approach is present.

Fair

Definition

A **Fair** recommendation means that the work group believes that the benefits exceed the harms (or that the harms clearly exceed the benefits in the case of a negative recommendation), but the quality of evidence is not as strong (grade II or III). In some clearly identified circumstances, recommendations

may be made based on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits outweigh the harms.

Implication for Practice

Practitioners should generally follow a **Fair** recommendation but remain alert to new information and be sensitive to patient preferences.

Weak

Definition

A **Weak** recommendation means that the quality of evidence that exists is suspect or that well-done studies (grade I, II, or III) show little clear advantage to one approach versus another.

Implication for Practice

Practitioners should be cautious in deciding whether to follow a recommendation classified as **Weak** and should exercise judgment and be alert to emerging publications that report evidence. Patient preference should have a substantial influencing role.

Consensus

Definition

A **Consensus** recommendation means that Expert opinion (grade IV) supports the guideline recommendation even though the available scientific evidence did not present consistent results or controlled trials were lacking.

Implication for Practice

Practitioners should be flexible in deciding whether to follow a recommendation classified as **Consensus**, although

they may set boundaries on alternatives. Patient preference should have a substantial influencing role.

Insufficient Evidence

Definition

An **Insufficient Evidence** recommendation means that there is both a lack of pertinent evidence (grade V) or an unclear balance between benefits and harms.

Implication for Practice

Practitioners should feel little constraint in deciding whether to follow a recommendation labeled as **Insufficient Evidence** and should exercise judgment and be alert to emerging publications that report evidence that clarifies the balance of benefit versus harm. Patient preference should have a substantial influencing role.

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Chapter 1

Pediatric Overweight and Obesity: Trends and Health Consequences

The United States is currently in the midst of an overweight/obesity crisis that affects not only adults but also the nation's youth.^{1,2} To accurately depict the national prevalence of childhood and adolescent overweight/obesity, it is important first to define the terms overweight and obese and then to use these definitions consistently. This chapter will provide the current overweight and obesity definitions as they apply to the pediatric population, age 2 through 18 years. It will also provide an overview of the health consequences related to pediatric overweight and obesity.

Definitions

In 2007, an Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity, made up of representatives from 15 health professional organizations, provided recommendations for the management of overweight and obesity in children and adolescents. The Expert Committee published a consensus document using evidence to recommend strategies for the screening, prevention, and treatment of childhood obesity.³ The Academy of Nutrition and Dietetics Evidence-Based Pediatric Weight Management Nutrition Practice Guideline (PWM NPG) are complementary and use the Expert Committee's terminology for framing treatment recommendations.⁴ The Expert Committee recommendations are discussed in greater detail in Chapters 5 and 10. The PWM NPG is discussed in Chapters 3, 4, 6, and 9. In addition, in 2010, the US Preventive

Services Task Force (USPSTF) issued revised recommendations for the screening, prevention, and treatment of childhood overweight and obesity. The USPSTF updated its terminology to be consistent with that of the Expert Committee.⁵

With regard to weight classifications, the Expert Committee recommends the following definitions³:

- Youth between the ages of 2 and 18 years with a body mass index (BMI) from the 85th to the 94th percentile for their age and sex should be considered *overweight*.
- Youth between the ages of 2 and 18 years with a BMI at or more than the 95th percentile for their age and sex should be considered *obese*.
- For children and adolescents with more severe obesity, an additional category (BMI greater than the 99th percentile) has been proposed to indicate a high likelihood of immediate medical problems and the urgency of intervening.

Table 1.1 summarizes pediatric weight terminology based on BMI as recommended by the Expert Committee.

Table 1.1: Terminology for Body Mass Index Categories^{3,4}

	Body Mass Index Percentile for Age and Sex			
	<5th	5th–84th	85th–94th	≥95th
Expert Committee Terminology	Underweight	Healthy weight	Overweight	Obese

In addition, more recent researchers have proposed additional definitions of severe obesity.⁶ These, as well as the use of BMI *z* scores as an alternative to BMI percentiles, will be discussed more in Chapter 2 and Chapter 7.

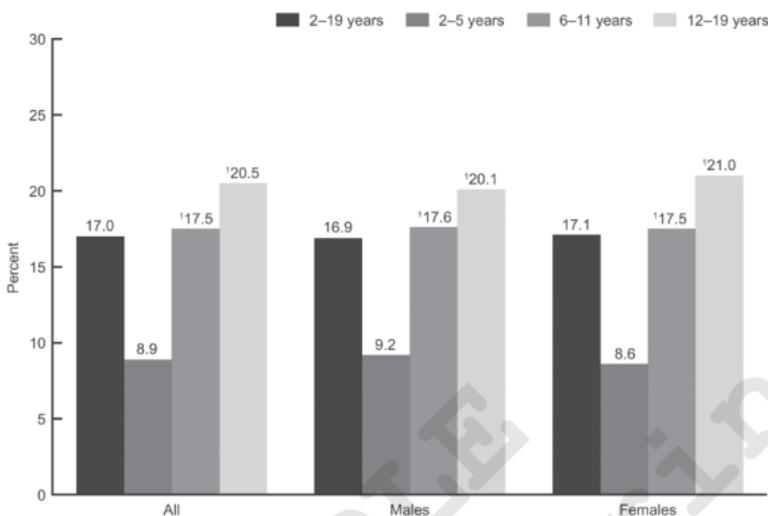
Prevalence

Since the 1970s there has been an alarming increase in the prevalence of overweight and obesity in our nation's youth. According to the Centers for Disease Control and Prevention, childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years.⁷ Childhood obesity is a complex issue. The main causes of excess weight in youth are similar to those in adults, including individual causes such as behavior and genetics. Behaviors can include dietary patterns, physical activity, inactivity, medication use, and other exposures. Some additional contributing factors in our society include the food and physical activity environment, education and skills, and food marketing and promotion.⁸

Progress toward reducing the nation's prevalence of weight issues is monitored using data from the National Health and Nutrition Examination Survey (NHANES). The most recent NHANES data (2011 through 2014) showed that the prevalence of obesity among US youth was 17% from 2011 through 2014.⁷ Overall, the prevalence of obesity was 8.9% among preschool children (2 to 5 years old), 17.5% among school-aged children (6 to 11 years old), and 20.5% among adolescents (12 to 19 years old). The same pattern was seen in both boys and girls.⁹ Figure 1.1 (see page 4) presents NHANES survey data from 2011 through 2014.

From 1999 to 2000 through 2013 to 2014, a significant increase in obesity was seen; however, between 2011 and 2012 and 2013 and 2014 no changes in obesity were noted.⁹

Although the prevalence of pediatric obesity has increased nationwide, NHANES data indicate that there are significant racial/ethnic and age disparities among children and adolescents. The prevalence of obesity among non-Hispanic Asian youth (8.9%) was lower than that for non-Hispanic white (14.7%), non-Hispanic black (19.5%), and Hispanic (21.9%) youth.⁹



¹Significantly different from those aged 2–5 years.

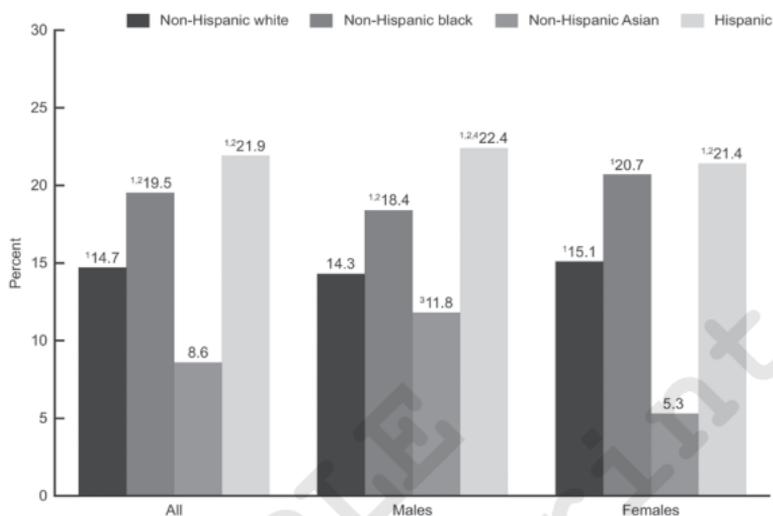
Reprinted from National Center for Health Statistics. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS Data Brief, No. 219. www.cdc.gov/nchs/data/databriefs/db219.pdf.

Figure 1.1: Prevalence of obesity among youth aged 2 through 19 years by sex and age: United States 2011 through 2014

Figure 1.2 compares the prevalence of obesity by race/ethnicity for adolescent boys and girls between 2 and 19 years old.⁹

The US government monitors and updates statistics on the prevalence of obesity in the pediatric population approximately every 2 years. Therefore, registered dietitian nutritionists (RDNs) and other health professionals should check the Centers for Disease Control and Prevention National Center for Health Statistics website (www.cdc.gov) for the most current pediatric obesity prevalence statistics for age, sex, and race/ethnicity.

The prevalence of childhood and adolescent obesity is also rising around the world. In 2016, The World Health Organization (WHO) put together the Commission on Ending



¹Significantly different from non-Hispanic Asian persons.

²Significantly different from non-Hispanic white persons.

³Significantly different from females of the same race and Hispanic origin.

⁴Significantly different from non-Hispanic black persons.

Reprinted from National Center for Health Statistics. Prevalence of obesity among adults and youth: United States, 2011-2014. NCHS Data Brief, No. 219. www.cdc.gov/nchs/data/databriefs/db219.pdf.

Figure 1.2: Prevalence of obesity among youth aged 2 through 19 years old by sex and race/ethnicity: United States 2011 through 2014

Childhood Obesity to provide policy recommendations to governments for preventing infants, children, and adolescents from developing obesity (further discussed in Chapter 10). The WHO definitions for pediatric obesity are different from those of the Expert Committee and are based on the number of standard deviations above either the WHO growth reference median for children 5 to 19 years old or the WHO Child Growth Standards median for children under age 5. More details about the WHO definitions and current world statistics of pediatric obesity can be found in the Report of the Commission on Ending Childhood Obesity.¹⁰

Health Consequences

Pediatric overweight and obesity are multisystem diseases with potentially devastating consequences.^{3,8-14} Type 2 diabetes, hyperlipidemia, and hypertension, as well as early maturation and orthopedic problems, are occurring with increased frequency in youth who are overweight or obese.^{3,11-16} In addition, children and adolescents who are overweight or obese experience psychosocial problems, such as low self-esteem, depression, and discrimination, more commonly than other children and adolescents.^{11,13,14} Finally, because children who are obese, particularly adolescents, are more likely to be overweight or obese as adults, their future health may also be in jeopardy.^{12,15,16} Obese adults who were obese as children experience more rapid and serious obesity-related complications than do people who maintained a healthy weight during childhood but became obese as adults.¹⁷ Research is now finding that the risk of pediatric overweight can begin as early as birth.¹⁸ Box 1.1 summarizes health conditions associated with pediatric overweight/obesity.

Orthopedic Conditions

Numerous orthopedic disorders are observed more commonly in children and adolescents who are obese. Most result from the impact of increased weight on the developing skeletal system.^{1,14,19}

- **Feet, leg, and hip abnormalities:** Youth who are overweight or obese can develop orthopedic abnormalities affecting the feet, legs, and hips as a result of inappropriate loading of the skeletal framework, particularly in areas involving the epiphyseal plates (unfused growth plates and softer cartilaginous bones, typically in the knee, ankle, and hip).¹⁹ Compared with children who are not obese, children who are obese reported a greater prevalence of fractures and musculoskeletal discomfort.¹⁹

Box 1.1: Health Consequences of Pediatric Obesity

Orthopedic Conditions

- Slipped capital femoral epiphysis
- Blount disease

Neurologic Conditions

- Pseudotumor cerebri
- Recurrent headaches

Pulmonary Conditions

- Asthma
- Sleep disorders (eg, sleep apnea)

Gastrointestinal Conditions

- Nonalcoholic fatty liver disease
- Cholecystitis
- Gallstones
- Gastroesophageal reflux

Endocrine and Metabolic Conditions

- Type 2 diabetes
- Insulin resistance or prediabetes
- Polycystic ovary syndrome
- Hirsutism
- Excessive acne
- Acanthosis nigricans
- Early puberty
- Metabolic syndrome

Cardiovascular Diseases

- Hypertension
- Dyslipidemia
- Atherosclerosis

Psychosocial Conditions

- Low self-esteem
 - Depression
 - Peer rejection
 - Eating disorders
-

- **Slipped capital femoral epiphysis:** This disorder of the hip's growth plate occurs between 9 and 16 years of age and has an incidence of approximately 11 cases per 100,000 children.^{19,20} It occurs more frequently when a child is overweight.²¹
- **Blount disease (*tibia vara*):** A condition that involves bowing of the legs and tibial torsion, Blount disease has been attributed to unequal or early excess weight-bearing. In a study conducted by Dietz and colleagues, approximately 80% of children with Blount disease were overweight or obese.²²

Neurologic Conditions

- **Pseudotumor cerebri** is a rare neurologic disease of unknown origin characterized by increased pressure in the skull, which often causes headaches. In the past, pseudotumor cerebri typically occurred in middle-aged women, but it now occurs more frequently at an earlier age, particularly in youth who are overweight or obese.²³ Epidemiologic studies indicate a 14-fold increase in the prevalence of pseudotumor cerebri in patients whose weight is more than 10% above the ideal and a 20-fold increase in prevalence in people whose weight is 20% more than the ideal.²⁴

Pulmonary Conditions

Children and adolescents who are overweight or obese often have pulmonary complications, such as asthma and sleep disorders.^{11,12,14,16}

- **Obstructive sleep apnea** is one of the most serious problems associated with obesity and is more common among children who are severely obese. Obstructive sleep apnea is the cessation of breathing during sleep, lasting 10 seconds or longer, and is characterized by loud snoring

and labored breathing. During these periods, oxygen levels in the blood may decrease dramatically. Studies show a strong association between pediatric obstructive sleep apnea and childhood obesity, and the condition can often result in poor school performance and disruptive behavior.²⁵⁻²⁷

- **Asthma:** The prevalence of obesity is reported to be significantly higher in youth with asthma than in peers without asthma.^{28,29} The risk of new-onset asthma is higher among children who are overweight, and boys have an increased risk compared with girls.²⁹

Gastrointestinal Conditions

Obesity is associated with several gastrointestinal problems ranging from constipation to more serious complications such as nonalcoholic fatty liver disease (NAFLD).

- **NAFLD** is a condition of growing concern because of the increasing prevalence of obesity and diabetes, which are significant risk factors. Like adults with this condition, most children with NAFLD are obese.³⁰ The spectrum of NAFLD ranges from isolated fatty infiltration (steatosis) to inflammation (nonalcoholic steatohepatitis, also known as NASH), fibrosis, and even cirrhosis.^{30,31} The exact prevalence is hard to determine; NAFLD can occur in very young children but is more prevalent in adolescents. In addition, it is more prevalent in boys; the male to female ratio is 2 to 1. It has been reported to differ significantly by race and ethnicity: fatty liver is present in 11.8% of Hispanic children, 10.2% of Asian children, 8.6% of white children, and only 1.5% of black children.^{31,32}
- **Gallstones** are more prevalent among children who are overweight and obese than among those who are healthy weight.³³

- **Gastroesophageal reflux disease and constipation** are among the common pediatric gastrointestinal problems exacerbated by obesity.^{34,35}

Endocrine Disorders

Impaired glucose tolerance, insulin resistance, and type 2 diabetes are some of the endocrine disorders increasingly associated with pediatric obesity.^{11,14,16}

- **Type 2 diabetes:** The incidence of type 2 diabetes in children and adolescents has increased dramatically in recent years. Type 2 diabetes is widely considered a chronic, progressive disease. Among children and adolescents, it is associated with hypertension, dyslipidemia, and fatty liver disease.³⁶⁻³⁹ In several studies, incidence of type 2 diabetes has increased from less than 5% of all new-onset pediatric diabetes diagnoses before 1994 to 30% to 50% after 1994.³⁷⁻³⁹ Risk factors for type 2 diabetes are BMI greater than or equal to the 85th percentile; family history of diabetes; and black, Hispanic, or Native American ancestry. In addition, other risk factors include diabetes- and obesity-related conditions such as polycystic ovary syndrome (PCOS), acanthosis nigricans, or cardiovascular risk factors.³⁴⁻³⁹
- **Prediabetes:** Increased risk for developing type 2 diabetes, sometimes called prediabetes, is a common complication of childhood and adolescent obesity. Prediabetes is defined by moderate abnormalities in fasting plasma glucose, glucose intolerance, or hemoglobin A1c³⁷ and indicates a high risk for the development of diabetes.^{38,39}
- **Early puberty:** Children who are obese tend to begin puberty earlier than children of healthy weight. When onset is premature, these children require an endocrinology evaluation just as children of healthy weight do.^{11,14,15}

- **PCOS:** Obesity in adolescents is being increasingly linked to PCOS.^{40,41} A main underlying problem is a hormonal balance. In women with PCOS, the ovaries make more androgens (male hormones that females also make) than usual.⁴⁰ Infrequent menses (fewer than nine cycles per year) is the most significant finding and should lead to further evaluation. Other findings include hirsutism, excessive acne, and acanthosis nigricans.¹¹
- **Acanthosis nigricans** is a disorder that causes light-brown to black rough areas or increased skin markings, usually on the back side of the neck. It is increasingly described in children who are obese. Although it is associated with hyperinsulinemia, it is more strongly associated with a high BMI.^{38,39} Up to 90% of pediatric patients with type 2 diabetes have acanthosis.³⁹

Cardiovascular Disease

Youth who are obese are more likely to have risk factors for cardiovascular disease, such as high cholesterol or high blood pressure. In one study, 70% of children with obesity had at least one cardiovascular disease risk factor, and 39% had two or more.⁴²

- **Hypertension** in children and adolescents seems to be increasing in both prevalence and rate of diagnosis.³³ This is due in part to the increasing prevalence of childhood obesity as well as growing awareness of this disease.⁴³⁻⁴⁵ Children with obesity are three times more likely to have hypertension than children who are healthy weight. In addition, children who are overweight (particularly teens) and have elevated blood pressure may be at increased risk for hypertension as adults.⁴⁵ Childhood blood pressure and changes in BMI are consistently the most powerful predictors of adult blood pressure across all ages in both sexes.⁴⁶

- **Dyslipidemia** is a group of disorders characterized by elevated levels of cholesterol, triglycerides, and low-density lipoproteins as well as low levels of high-density lipoproteins in the blood. Lipid-level abnormalities are among the most common obesity-related medical conditions.^{47,48} More than 50% of children who are obese have lipid abnormalities, as measured by fasting lipid profile. Obesity during childhood and adolescence is associated with increased risk for major cardiovascular events during adulthood, independent of adult obesity status.⁴⁸

Metabolic Syndrome

Metabolic syndrome is a clustering of risk factors for cardiovascular disease and diabetes mellitus, including increased waist circumference, elevated blood pressure, increased triglycerides, decreased high-density lipoprotein cholesterol, and increased blood glucose. The underlying risk factors seem to be related to obesity and insulin resistance.⁴⁹ Currently, there is a lack of consensus on how to define metabolic syndrome in the pediatric population. In adults, metabolic syndrome is defined as three or more of the following risk factors: elevated waist circumference, triglyceride levels, blood pressure, and fasting plasma glucose.⁴⁴ One study found metabolic syndrome in 4% of all children but 30% of children who are obese.⁵⁰ Another study found that the risk of metabolic syndrome among children and adolescents who are overweight increased by approximately 50% with each half-unit increase in the BMI score (equivalent to an increase of half a deviation in BMI).⁴⁹

Psychosocial Conditions

Psychosocial issues involve psychological health and the ability to relate to family members and peers. Childhood obesity is linked with several psychosocial problems, including depression, low self-esteem, and eating disorders.^{51,52}

- The likelihood that a child or adolescent who is severely obese will have a lower health-related quality of life was 5.5 times greater than that for a healthy child or adolescent, and similar to that for a child diagnosed with cancer.⁵³
- Children and youth who were overweight and had decreased self-esteem reported increased rates of loneliness, sadness, and nervousness, and were more likely to smoke and consume alcohol.⁵⁴
- Adolescents who are overweight are more likely to be socially isolated and peripheral to social networks than adolescents who are healthy weight.⁵⁵
- Weight issues often cause body dissatisfaction, and researchers hypothesize that developing a negative body image places girls at risk for eating disorders.^{51,56} Adolescents who are overweight or obese show higher lifetime rates of eating disorders, especially bulimia nervosa.⁵⁴ About 20% to 40% of adolescents seeking obesity interventions report symptoms of binge eating disorders.⁵⁶

Summary

Children and adolescents who are overweight or obese face serious medical, emotional, and social consequences. As both adult and pediatric obesity remain a difficult challenge, RDNs must stay abreast of current recommendations and research pertaining to prevalence, assessment, treatment, and prevention strategies. This pocket guide blends current recommendations and evidence-based guidelines on the assessment, treatment, and prevention of pediatric obesity.

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Pediatric Weight Management

Second Edition

This pocket guide integrates evidence-based practice guidelines into individualized nutrition care with practical and realistic advice for working with children and adolescents with overweight and obesity issues. This resource prioritizes interventions that reduce the risk of immediate and future health complications.

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Authors **Mary Catherine Mullen, MS, RDN**, and **Jodie Shield, MEd, RDN**, have extensive experience and have co-authored six books on pediatric weight management.



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