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Overweight Children and Adolescents: A Clinical Report of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition

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ABSTRACT
Childhood overweight and obesity are major health problems with immediate and long-term consequences of staggering magnitude. Despite this, there are few preventive and therapeutic strategies of proven effectiveness available to public health and clinical practitioners. Accruing such evidence is currently and appropriately a health policy priority, but there is an urgent need to intervene even before comprehensive solutions are fully established. The aim of this Clinical Report on Overweight Children and Adolescents is to present information on current understanding of pathogenesis and treatment of overweight and obesity. We report on the epidemiology, molecular biology and medical conditions associated with overweight; on dietary, exercise, behavioral, pharmacological and surgical treatments; and on the primary prevention of overweight in children and adolescents. ***JPGN 40:533–543, 2005.*** © 2005 Lippincott Williams & Wilkins

The United States is currently experiencing an epidemic of childhood overweight and obesity. The proportion of children who are overweight with a body mass index (BMI) >95th percentile for age and gender has increased with each national nutritional survey since the early 1960s. The percent of children 6 to 11 years of age that are overweight more than doubled from 6.5% to 15.3% between the late 1970s and 2000 (1). The percent of overweight adolescents aged 12 to 19 years tripled from 5.0 to 15.3% during the same period (1). Other recent national data suggest that close to 21% of African-American and Hispanic children are obese and over 12% of non-Hispanic white children are obese (2). These numbers double if one includes children defined as at risk for overweight with a BMI greater than the 85th percentile. Although the prevalence of childhood overweight is increasing most rapidly among African-Americans, Hispanics, and the poor and middle classes, no portion of the population is unaffected (2). Childhood overweight is a chronic health problem and is becoming the most common health issue currently facing children in the United States.

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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The increasing rates of overweight and obesity have a significant impact on the overall health of Americans. A recent report from the United States Surgeon General revealed that 300,000 Americans died in 2000 from obesity-related causes and that the United States expended $117 billion in obesity-related economic costs. In a study of one million members of managed care organizations in the United States, 45% of 132,900 cases of hypertension, 85% of 58,500 cases of type II diabetes, 18% of 51,500 cases of hypercholesterolemia and 35% of 16,500 cases of coronary heart disease were attributable to obesity (3). The health care costs of gallbladder disease, stroke, osteoarthritis of the knee and endometrial cancer attributable to obesity are estimated at $345.9 million annually (3). Recently, the medical costs associated with overweight were compared with the medical costs associated with smoking 4). The cost of both outpatient and inpatient care for current smokers is 21% more than that of nonsmokers; the cost of caring for obese individuals is 36% more than the cost associated with individuals of normal weight. Medication costs are 28% higher in smokers; medication costs are 77% higher for the obese. This study also showed that the medical costs of an obese 30-year-old person were equivalent to the medical costs of a non-obese 50-year-old person.

Because childhood overweight and obesity are such widespread problems, the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHN) appointed the Childhood Overweight

Working Group to provide practical information to pediatric gastroenterologists and primary care physicians on evaluation and treatment of overweight and obese children. This Clinical Report is designed to complement previously published treatment recommendations such as the Expert Committee Recommendations on the Evaluation and Treatment of Childhood Obesity (5).

BACKGROUND

Definition

The Centers for Disease Control and Prevention (CDC) recommends using the percentile BMI for age and gender as the most appropriate and easily available method to screen for childhood overweight or at risk for overweight. BMI is calculated by dividing the weight in kilograms by the height in meters squared. Age and gender norms for BMI are readily accessible (6). BMI correlates with adiposity and with complications of childhood overweight such as hypercholesterolemia, hypertension and later development of cardiovascular disease. Although more precise measures of lean body mass and body fat such as dual x-ray absorptiometry (DEXA) may be appropriate for clinical studies, BMI norms are particularly helpful for screening in busy office practices and for population assessment.

Because BMI norms for youth vary with age and gender, BMI percentiles rather than absolute BMI must be determined. The cutoff values to define the heaviest children are the 85th and 95th percentiles. In adolescence as maturity is approached, the 85th percentile roughly approximates a BMI of 25, which is the cutoff for overweight in adults. The 95th percentile roughly approximates a BMI of 30 in the adolescent near maturity, which is the cutoff for obesity in adults. The cutoff recommended by an expert committee to define overweight (BMI $\geq$95th percentile) is a conservative choice designed to minimize the risk of misclassifying nonobese children (5).

Molecular Biology

The molecular biology of obesity is not fully understood. The discovery of the hormone leptin promised to revolutionize the field of obesity. Indeed, it may have done so, as it has given validity to the biologic basis of obesity and resulted in the identification of a number of new metabolic pathways impacting food intake and energy balance. However, the true role of leptin and the leptin receptor in human obesity remains obscure. Several hormones and proteins have been identified in animal models that may regulate appetite and weight. Although it is likely that the same general mechanisms regulating appetite in animals apply to humans, the importance of particular neurotransmitters may vary considerably. At this time, the role of hormones and neurotransmitters in determining overweight in humans remains unknown. Specific enzymatic abnormalities have been described in only a few obese humans. Enzyme abnormalities and metabolic defects cannot account for the rapid increase in childhood obesity over the last three decades.

Epidemiology

Debate continues on the relative importance of genetic and environmental factors in the development of obesity in adults and children. Estimates of the degree to which genetic factors influence body fatness range from 25% to 80% (7). Nonetheless, changes in environmental and social factors explain much of the doubling of childhood overweight in the last 30 years. The increased prevalence of overweight reflects an increase in positive energy balance caused by increased caloric intake and/or decreased physical activity among children in the last three decades. Although means to document precise changes in caloric intake or energy expenditure are limited, it appears that children are less active today and probably consume more calories than they did 30 years ago.

National transportation surveys show that walking and bicycling dropped 40% among children aged 5 to 15 years between 1977 and 1995 (8). The National Youth Risk Surveillance Survey found that daily participation in high school physical education declined from 42% to 29% between 1991 and 1999 (9). Other environmental factors may significantly contribute to this decline. Children living in high-crime neighborhoods appear to spend less time outdoors because of safety concerns (10). Children are spending an increasing amount of time in sedentary activities. In one study, the average child spent 6 hours a day watching television or computer screens, playing video games or doing homework (11). Time diaries show that families spend threefold to fourfold more time watching television than they spend talking with each other (12). Studies have documented a direct correlation between television viewing and overweight (13–15).

While physical activity has declined, consumption of high-calorie food products has increased. Mean caloric intake increased among adults between the several National Health and Nutrition Examination Surveys (NHANES); NHANES I from 1971 to 1974, NHANES II from 1976 to 1980, NHANES III from 1988 to 1994 and NHANES from 1999 to 2000 (16) The increase in caloric intake described in these reports is consistent with previously reported trends in dietary intake in the United States (17). USDA survey data for the 1977–1996 period suggests that consumption of food away from home, increased energy consumption in the form of salty snacks, soft drinks and pizza and increased portion size are factors contributing to the increased energy intake in the United States (18,19). In adolescent boys, soft-drink consumption increased approximately 65% from 1989–1991 to 1994–1995 (20,21). The number of families

reporting that the whole family eats together has declined by approximately one third over the last 20 years (22). Typically, one third of meals are now eaten outside the home, often at fast food restaurants where fat comprises 45% to 55% of calories ingested (23). A comprehensive survey of school lunch programs revealed that fat accounted for more than 37% to 40% of the calories in most school lunches (24). Of 500 schools surveyed, only 1% served meals with an average of less than 30% of total energy from fat.

Contrary to the perception of many families of obese children that their children are overweight because of ''low metabolism,'' there is little evidence that the metabolic rate of obese children is different from that of non-obese children. In fact, overfed overweight and normal weight adolescents gain weight at the same rate (25). Nonetheless, small and subtle differences in metabolism might exist between obese and non-obese children. Even small deviations in the regulation of dietary intake or metabolic rate can lead to energy imbalance and inappropriate weight gain. In adults, a chronic intake of only 100 kcal per day greater than expenditure will lead to weight gain of 10 pounds per year. Differences in intake, appetite or metabolic rate of this small magnitude are difficult to accurately measure. Although small differences in metabolic efficiency may increase the risk for the subsequent development of overweight and obesity, obese adolescents actually have higher total daily energy expenditure and resting energy expenditure than non-obese adolescents (26). This suggests that obese children need to eat more to maintain their higher body weight. No differences in basal metabolic rate, sleeping metabolic rate, respiratory quotient, heart rate or total energy expenditure have been detected in normal weight children with or without a familial predisposition to overweight (27).

Persistence of Overweight and Obesity

Understanding which children are likely to outgrow overweight and obesity and which are likely to remain persistently overfat is critical in the assessment and targeting of obesity treatments. In longitudinal studies of infants, the likelihood that overweight will persist into adulthood is uneven and less than might be expected. Similarly, a 20-year follow-up of overweight preschool children found that by adulthood, 25% were overweight and 75% were normal weight (28). In the most comprehensive longitudinal study of the adult outcome of childhood overweight, Whitaker et al. demonstrated that 50% of children obese at 6 years of age remained obese as adults. Eighty percent of children who were obese at 10 to 14 years of age and who had at least one obese parent remained obese as adults (29). Parental obesity increases the risk of overweight in children by two to threefold. It should be recognized that available information on the persistence of childhood overweight and obesity were collected several decades ago. Current eating habits and activity levels may alter these risks in today's children. In general, an overweight or obese child who remains largely sedentary and does not modify caloric intake is unlikely to ''outgrow'' this condition regardless of age or family genetics.

Data suggest that humans are particularly prone to the development of obesity during certain periods in their development (30). Longitudinal studies indicate that children who begin to increase their BMI percentile before age 5 years are at increased risk of becoming obese adults (31). Girls are particularly prone to developing persistent overweight during adolescence. At puberty the lean body mass of the average male increases and the body fat decreases by approximately 40%. In contrast, the body fat of adolescent females increases approximately 40% (32). Approximately 70% of obese adolescent males will subsequently normalize their weight, whereas only 20% of obese adolescent females will do so (33). Because these data were gathered before the recent increase in obesity prevalence, it cannot be assumed that today's obese adolescents will normalize their weight comparably.

Medical Conditions Associated with Childhood Overweight and Obesity

Laboratory tests and radiologic examinations are rarely helpful for diagnosing the causes of overweight. However, short stature associated with overweight may indicate the need to evaluate for hypothyroidism, Cushing syndrome or Turner syndrome. A genetic evaluation may be helpful in the assessment of overweight associated with mental retardation (i.e., Prader-Willi, Laurence-Moon-Biedl, Cohen syndrome). Fasting lipid profile and fasting glucose should be performed in obese or overweight children. Liver function tests should be obtained because steatosis or steatohepatitis is generally asymptomatic. Depending on age, symptoms and physical examination, many patients will require thyroid function tests and measuring luteinizing hormone, follicle-stimulating hormone, and testosterone, fasting insulin and hemoglobin A1C to identify overweight-related medical complications such as hypothyroidism, hyperinsulinism, diabetes or polycystic ovary syndrome. Radiological testing is necessary to diagnose slipped capital femoral epiphyses and Blount disease.

Although many of the complications of obesity only become clinically apparent in adulthood, obese children may be affected as well. Hypertension or an abnormal lipid profile occurs in the majority of overweight children as young as 5 to 10 years of age (34). Between 21% and 25% of obese children have impaired glucose tolerance; 4 percent of obese adolescents have non-insulin dependent diabetes mellitus (35). Type II non-insulin dependent diabetes mellitus accounts for as many as 45% of youth with newly diagnosed diabetes mellitus (36),

and most of these cases arise in obese children. Life-threatening complications, such as obstructive sleep apnea, can affect severely obese children and adolescents (37). In fact, few organ systems are unaffected by overweight and obesity in childhood (Table 1).

Gastrointestinal Conditions Associated with Childhood Overweight and Obesity

Obesity accounts for 8% to 33% of the gallstones observed in all children (38,39) and the majority of gallstones in children with no underlying medical conditions (i.e., hemolytic disease, congenital heart disease, prolonged total parenteral nutrition). Obesity or eating behaviors related to overweight is estimated to increase the relative risk of gallstones by over four-fold in children (40).

Non-alcoholic fatty liver disease, the primary liver abnormality in overweight and obese children, consists of steatosis (increased fat in the liver without inflammation) and steatohepatitis (increased liver fat with inflammation). Steatosis is considered a benign condition that does not progress to cirrhosis. Approximately 30% of obese adults with elevated aminotransferases have steatohepatitis with fibrosis or cirrhosis on liver biopsy, and approximately 40% of those patients have progressive liver disease (41–43). A report by Tominaga et al. suggests that at least 16% of obese Japanese children with elevated transaminases have fatty liver with associated fibrosis or cirrhosis on liver biopsy (44). Unfortunately, the degree of elevation of serum aminotransferase concentration does not predict severity of liver involvement and does not distinguish between steatosis and steatohepatitis. Similarly, hepatic ultrasound or magnetic resonance imaging provides little information on the degree of fibrosis or cirrhosis.

TABLE 1. *Side effects associated with childhood overweight and obesity*

	Reference
Hypertension	(106–110)
Dyslipidemia	(111–116)
Orthopedic problems	
Slipped epiphyses	(117–120)
Blount's disease (tibea vara)	(121)
Endocrine	
Diabetes	(35, 36, 122, 123)
Insulin resistance	(35, 117–127)
Polycystic ovary syndrome, irregular menses	(128–132)
Gastroenterological	
Gallstones	(38–40, 133,1)
Steatohepatitis	(41–49, 51,134)
Respiratory	
Asthma	(135–137)
Sleep apnea	(37,138–140)
Neurological (i.e., pesudotumor cerebri)	(141–143)

Increasingly, steatohepatitis is recognized as a severe co-morbidity in overweight and obese children. Moran et al. first demonstrated severe hepatitis and fibrosis in three children aged 10 to 13 years (45). Baldridge et al. described severe steatohepatitis with portal inflammation and portal fibrosis in 14 obese children (46). Kinugasha et al. reported significant steatohepatitis in 8 of 11 obese Japanese children who underwent liver biopsy for elevated liver enzymes (47), whereas Rashid and Roberts found severe fibrosis or cirrhosis in one third of children undergoing liver biopsy for the same indication (48).

The diagnostic criteria for non-alcoholic fatty liver disease among obese adolescents are inadequately defined and the prevalence is therefore unknown. Using hepatic ultrasound, Tominaga et al. found fatty changes in approximately 22% of obese boys and girls aged 4 to 12 years (44). A recent national study found approximately 6% of overweight adolescents and 10% of obese adolescents had abnormal alanine aminotransferase levels (49). The majority of the elevations were mild, with only 1% to 3% more than twice normal. Nevertheless this is a 12-fold increase in prevalence over the general population. There are currently no means short of liver biopsy to predict whether a child has steatosis, steatohepatitis or fibrosis.

The mechanism of elevated hepatic enzymes in overweight and obese adolescents may involve a combination of hyperinsulinism, hyperlipidemia and decreased antioxidant levels (50). Preliminary data in an open labeled, uncontrolled study by Lavine et al. suggest that vitamin E treatment may be beneficial in some children (51). Preliminary data in adults suggest that metformin (52) and betaine (53) may be helpful in treating steatohepatitis.

Because other chronic liver diseases can occur in obese children, elevations in liver chemistries in obese children should prompt the same evaluation for etiologies of chronic liver disease that would be performed in children of normal weight. In particular, Wilson disease may cause elevated liver enzymes as well as steatosis. Obese children with persistently elevated serum transaminases, particularly those whose elevations remain over twice normal, require liver biopsy to exclude other causes of liver pathology and to determine the presence and severity of fibrosis or cirrhosis in those with steatohepatitis.

TREATMENT

Comprehensive Programs: Diet, Exercise, and Behavior Modification

Superficially, it would seem that the treatment of overweight is straightforward: counsel children to eat less and be more physically active. In practice, treatment of childhood overweight is time-consuming, frustrating, difficult and expensive. Comprehensive programs that

include counseling on dietary, behavioral and activity changes can be successful, although the critical support systems to help sustain changes in behavior are often lacking (54).

Readiness. At the outset it is important to assess the level of concern of each family member about the child's weight. If one parent remains unconcerned, mixed messages will be sent to the child that can confound treatment. Many families welcome an opportunity to address the problem of overweight or obesity in their children. However, some families may be unwilling or unable to make necessary changes; some families are unconcerned about their child's weight; other families may feel that the excess weight is inevitable or that personal circumstances make eating and activity changes too difficult. Because lack of readiness may lead to failure, frustration and reluctance to address the problem in the future, deferring treatment or referral until the family is ready to make changes may be appropriate. Physicians can use the Stages of Change model to increase a family's readiness. For instance, if a family is not concerned about obesity, then education about current medical conditions or risks in the family could move the family from precontemplation to contemplation.

Treatment Goals. Individuals presenting to weight treatment centers usually have expectations of weight loss that far exceed what can be realistically achieved. For instance, the typical adult patient presenting for weight loss desires to lose 75 pounds (55). Unrealistic goals concerning weight loss or changes in exercise habits and eating patterns can undermine the child's confidence and reinforce a fatalistic attitude towards the child's weight problem. Unrealistic expectations may contribute to dropout and relapse in those who successfully make dietary and behavioral changes.

Children in behavioral weight programs tend to lose between 4 and 15 pounds (56–58). For the growing child, weight maintenance is often an achievable, realistic goal. Weight maintenance is always the first goal. In addition, children and their families need to recognize that sustainable weight loss of as little as 5% to 10% results in significant improvement in cholesterol, blood pressure and blood glucose (59).

Family Involvement. Treating overweight involves understanding the eating and activity habits of the entire family. Parents buy the food, cook the food and model eating patterns. Parents also provide access to activities and either encourage or discourage television viewing. Therefore, changing eating and activity habits is an active process involving the entire family. Such changes demand considerable conscious effort and support. Parents need to provide access to healthy, nutrient-dense foods and snacks and opportunities for the child to increase physical activity. Parents can reinforce positive eating and activity behaviors with rewards not based on food, money or gifts. Unfortunately, many families have difficulty identifying non-monetary, non-food rewards. A typical reward could involve quality family time such as a family outing to a park or playground (Table 2). Rewards are generally recommended for diet and physical activity change rather than for weight loss. Praise is an essential component for changing children's attitudes and behaviors. Family dynamics are also important. It is vital that children be offered consistency. Children of divorced parents who live in two households may become confused if one household supports treatment and the other does not. Similarly, grandparents must be willing to support the treatment.

A family therapist or behavioral psychologist is often necessary to facilitate change. In university-based programs, psychological counseling is usually available. In office-based practices, it may be necessary to network with local psychologists to find a counselor interested, empathetic and skilled in behavioral management techniques and family counseling. Most successful weight control programs use behavior modification techniques to reduce caloric intake and increase activity (60,61). Commonly used strategies to change behavior include self-monitoring of eating and activity, modification of the environment to decrease stimuli for eating or inactivity and positive reinforcement for new behaviors.

Dietary Counseling. Instead of focusing on dietary restriction, dietary counseling is aimed at improving the nutritional quality of the diet. A common sense approach to eating is recommended (Table 3). Parents should take charge of meal times and food choices but should not force children to eat certain foods. Sit-down meals involving the entire family and without distractions such as television are ideal. In this way, dinnertime is not just about eating but also involves discussions of the day's events and building relationships

Children should not be placed on ''fad'' diets. A low-saturated fat, moderate total-fat diet ($\leq$30%) with five fruits and vegetables a day is consistent with the food guide pyramid and is generally recommended. High-fiber foods and avoidance of highly refined starches and sugars are also likely to decrease caloric intake. Although counting calories is tedious and unreliable, self-monitoring of intake may help children learn to eat only when they are hungry and also help them to focus on which foods they choose to eat. Reviewing school lunch menus and helping parents identify low-fat school lunch

TABLE 2. *Behavioral reinforcement: non-food rewards*

Family sports (swimming, skating, basketball, hiking, bike ride, etc.).
Family games (chess, checkers, monopoly, playing cards, board games, tag, puzzles, flash cards, etc.).
Family activities (trip to museum, horseback riding, trip to sports event, picnic, building models, fishing, bowling, gardening, cooking together, camping, photography, making gifts, art projects, etc.).
Special time with each parent.
Arranging visits with relatives or friends.

TABLE 3. *Approach to dietary modification*

Only water or non-calorie drinks between meals and snacks (coming to the table a little hungry will improve eating)
8 ounces of non-milk calorie drink (juice, soda, Kool-Aid, sports drink) per day (4 ounces for children under age 6)
Skim, 1/2% or 1% milk.
Pack a lunch (4 oz. of lean meat or cheese on two slice of bread, fruit, salad, or vegetable, milk).
Review school lunch menus to identify healthy menu items.
Second servings only of fruit and vegetables (not counting potatoes).
Meat portions should be the size of the palm, starch portion 1/2 to 3/4 cup, the rest fruit and vegetables.
Restaurant eating once a week or less, rare fast food and buffet-style restaurants.
Avoid low-fat cookies, cakes, candies and ice cream (These foods are often enriched with sugar. In addition, snacking on ''low-fat'' desserts undermines the message that fruit and vegetables are appropriate snacks and desserts.).
Frozen lean dinner and canned vegetables could replace restaurant meal to save time.
Use cooking spray to ''grease'' pan, instead of frying.
Use whole grain breads, cereals, and pastas.
Keep fruit and vegetables but up and in the refrigerator.
Remove temptations such as cookies, chips, and ice cream from the house.
Salad should contain vegetables - not cheese, eggs, meat or bacon bits.
Toss the family salad before serving to decrease dressing use.
Meals are served at the family dinner table.
Television should be turned off during meals
Plan meals two to three days in advance (freeze unused portions for quick future meals).
Slow down - meals may last at least 20 to 30 minutes.
Shop in the grocery store at least once/week to insure that fresh foods are in the home.
Eat regularly - 3 meals and 1–2 snacks/day; do not ship meals. This will prevent too from getting too hungry and overeating.

selections may also result in healthier food choices by the child (62). In some cases a structured diet, which does not forbid any foods but balances the amount of high and low calorie foods, is appropriate. A dietitian can provide specific instructions for the diet (63).

Physical Activity and Exercise. Any form of increased physical activity is beneficial, provided that activities are age-appropriate and enjoyable. In postpubertal children, weight training increases lean body mass, which can result in increased basal metabolic rate. Fat loss associated with weight training may sometimes be counterbalanced by increased muscle mass. Weight training is generally not recommended for prepubertal children unless proper resistance training techniques and safety precautions are followed. Preadolescents and adolescents should avoid competitive weight lifting, power lifting, body building and maximal lifts until they reach physical and skeletal maturity. Aerobic exercise and endurance training increase the ability to oxidize fats (64,65). Light exercise such as walking provides valuable family time together and increased caloric expenditure.

The best form of activity is any form that is sustainable. For prepubertal children, simply increasing time spent in free play, especially outdoors, is likely to be beneficial. Activity or exercise programs can be designed to increase the interaction between parents and children (e.g., playing basketball with a parent or family walks) or with other children (e.g., participating in karate with a friend). Most children find periods of defined exercise, such as aerobic videos or treadmills, boring and unpleasant and may not continue these activities. Team sports, individualized sports such as dance, family activities such as bike riding and unstructured outdoor play are all options with appeal for different children. Behavioral research emphasizes that patients are more likely to exercise and prefer exercise in situations where they have a choice of the type of exercise (66,67). Limiting sedentary behaviors such as television viewing may be the most effective way to facilitate physical activity and weight loss in children (68–70). The American Academy of Pediatrics recommends limiting television viewing to 1 or 2 hours per day (71). Table 4 lists strategies to increase physical activity.

Recommendations of Expert Committees. Faced with an epidemic of childhood obesity but incomplete data on the most efficacious treatment, the Maternal and Child Health Bureau, Health Resources and Services Administration convened a committee of experts in childhood overweight to provide those who care for children with practical directions on evaluation and treatment of overweight children (5). Health care providers can apply these recommendations to address obesity in an office

TABLE 4. *Strategies to increase physical activity*

All ages:
Television, computer, videogames $\leq$ 1–2 hours per day.
Family activity every weekend (bike riding, trips to zoos, bowling, board games, house and yard projects, hikes, library, museum, etc.).
Older Children:
Walk with your friend instead of talking to him/her on the phone.
Walk the dog.
Choose a part time job that is active (stock shelves rather than run the cash register, assist at the local elementary after-school program and organize gym games).
Put on headphones and dance in your room.
Team sports - check out the school and local recreations center.
Marching band.
Classes - dance, material arts, adults swimming lessons, tennis.
Aerobics class or tape.
Buy a pedometer ($10–$15) and aim for an increase of 2,2000 steps above baseline in a day, every day.
Grade School:
Team sports.
Classes.
Jump rope.
Basketball or soccer.
Bikes and scooters.
In aftercare, play in the gym or on the playground for a half-hour BEFORE homework.
At home, play outdoors for a half-hour BEFORE homework.
Preschool:
Outdoor play every day (raincoats, boots, mittens, and hats - play in the puddles and snow).
Indoor physical play area: mats, ''nerf'' balls, bouncy balls, scooter toys.
Buy active toys rather than computer games and video tapes.

visit. However, clinicians must consider each family's circumstances when they recommend changes; neighborhood safety, parents' work schedules and family finances will affect eating and activity options. Table 5 presents the committee's general approach to treatment. Because parents are responsible for instituting eating and activity changes, they need support and guidance in basic parenting skills, summarized in Table 6.

Commercial Weight Loss Programs. Many medical centers offer self-pay programs for weight control or weight loss in children. Participants generally meet in groups weekly for approximately 3 months and receive guidance in eating, activity and behavior modification. Parents usually participate in sessions with their children or in parallel sessions for parents. A 3-month adolescent overweight program using behavioral techniques to change diet and exercise showed a 5.9% change in relative weight at 3 months and a 9.9% decline at 15 months with a dropout rate of 16% (72). Other programs have not published their short-term and long-term effects. Some adolescents participate in commercial adult weight loss programs, although studies of the effectiveness of these programs in teens have not been performed. Of concern is that the personal and emotional issues related to eating and obesity discussed in these programs are generally targeted towards adults rather than adolescents.

Intensive Therapies for Severely Obese Children. In rare circumstances, adolescents with marked obesity benefit from rapid weight loss. Aggressive weight loss therapy includes restrictive dieting, pharmacological therapy, or even surgery. Potential physiologic harm from rapid weight loss from any of these therapies include slowing or cessation of linear growth, loss of lean body mass, inadequate nutrient intake, and gallstones.

TABLE 5. *General approach to therapy*

Intervention is to begin early.
The family must be ready for change.
Clinicians should educate families about medical complications of overweight.
Clinicians should involve the family and all caregivers in the treatment program.
Treatment programs should institute permanent changes, not short-term diets or exercise programs aimed at rapid weight loss.
As part of the treatment program, a family is to learn to monitor eating and activity.
The treatment program should help the family make small, gradual changes.
Clinicians encourage and empathize, but not criticize.
Treatment goals need to be clearly established (improved healthy eating choices, increased levels of activity, decreased sedentary, behaviors, less "food fights, improved self-attribution).
Establish *realistic* weight goals.
Clinicians need to identify and address issues concerning body image, self-esteem, depression teasing, and family conflicts about weight.

Adapted with permission from Barlow SE, Dietz WH. Obesity evaluation and treatment: expert committee recommendations. *Pediatrics* 1998;102:e29.

TABLE 6. *Parenting skills for weight control*

Parents determine foods in the house.
Parents determine when and where children eat.
Parents determine the foods that arc offered.
Children determine whether and low much they will eat.
Find reasons to praise the child's new behaviors.
Food should not be used as a reward or punishment.
Parents can ask for ''rewards'' for children in exchange for the changes in their own behavior.
Establish daily family meal and snack times.
Parents or caregivers determine what food is offered and when, and the child decides whether to eat.
Offer only healthy options.
Remove temptations.
Be a role model.
Be consistent.
Never humiliate or shame.

Adapted with permission from Barlow SE, Dietz WH. Obesity evaluation and treatment: expert committee recommendations. *Pediatrics* 1998;102:e29.

Protein-Sparing Modified Fast. Patients with severe obesity may benefit from strict diets such as the protein-sparing modified fast, a hypocaloric, ketogenic diet designed to provide enough protein to minimize loss of lean body mass during weight loss. The patient consumes 1.5 to 2.5 g of protein per kilogram of ideal body weight each day (73–76), which is the equivalent of 6 to 10 g of lean meat or fish per kilogram of ideal body weight. The protein intake can be in the form of a protein drink. Intake of carbohydrate must be low enough to maintain ketosis. In the authors' experience, patients can consume low-carbohydrate vegetables (e.g., lettuce, cruciferous vegetables) ad libitum and still maintain ketosis documented by ketonuria. Benefits of this diet are relatively rapid weight loss (1 to 2 kilograms per week) and anorexia induced by ketosis. Complications include protein losses (72,74,77), hypokalemia, hypoglycemia (particularly in the very young), inadequate calcium intake and orthostatic hypotension (78). Potassium and calcium supplementation and adequate calorie-free fluid intake can minimize these complications.

Such diets should only be implemented in conjunction with a multidisciplinary team including an experienced physician, nutritionist and behavioral (or family) therapist. Overall, protein-sparing modified fast regimens seem reasonably effective when performed under medical supervision and result in more rapid weight loss than conventional dietary and behavioral therapy, at least in the short term. Results establishing long-term beneficial outcome after protein-sparing modified fast are not available.

Pharmacological Treatment. Randomized placebo controlled trials in obese adults demonstrate modest but significant benefit of pharmacological interventions. The two drugs most carefully evaluated are orlistat and sibutramine. In clinical trials of these drugs, subjects also received education and behavior modification to increase

physical activity and decrease calorie intake. Orlistat (79,80), an enteric lipase inhibitor, blocks absorption of approximately 30% of dietary fat and has recently been approved for use by children aged 12 to 16 years in conjunction with a reduced-calorie diet. The recommended dose of orlistat is 120 mg three times per day with meals. A multivitamin containing fat-soluble vitamins should also be taken because orlistat can reduce absorption of these vitamins. There are published studies in adolescents of the appetite suppressants fenfluramine (83,84) and sibutramine (85). Sibutramine (81,82) suppresses appetite by inhibition of serotonin and noradrenaline reuptake. The package insert accompanying sibutramine indicates its use for patients ≥16 years. Sibutramine use resulted in an average weight loss of 7.8 kg over 12 months in a randomized, double-blind, placebo-controlled trial of 82 adolescents aged 13 to 17 years. However, 33 subjects required dose reduction or discontinuation because of side effects. Fenfluramine is an agent that increases release and blocks reuptake of serotonin. The Food and Drug Administration withdrew it from the market in 1997 after right-sided heart valve lesions were observed in adults treated with the medication. Other available prescription appetite suppressants include phentermine and phendimetrazine, but these are not approved by the United States Food and Drug Administration for long-term use. Even in the best circumstances, medications such as orlistat, sibutramine or phentermine generally produce only modest weight loss of 3% to 8% compared with placebo; however, a subset of patients may achieve more substantial weight loss. In general, use of Food and Drug Administration approved prescription medications in children awaits studies of safety and efficacy.

Ephedra and related compounds such as ma huang are constituents of many widely promoted over-the-counter and herbal appetite suppressants. Because of the potential of these agents for abuse and dependence and their link to adverse side effects such as hypertension, palpitations, coronary spasm and death (86), the FDA recently banned the sale of all supplements containing ephedrine alkaloids.

Other drugs have been used to produce weight loss in children with selective conditions: metformin in obese adolescents with insulin resistance and hyperinsulism (87), octreotide for hypothalamic obesity caused by intracranial tumors (88), growth hormone in children with Prader-Willi Syndrome (89) and leptin for congenital leptin deficiency (90). Such medicines are not appropriate for general use in overweight children.

Gastric Bypass Surgery. There are few data on bariatric surgery in obese adolescents and none in younger children. In 1975, Soper et al. first reported 18 morbidly obese adolescents and young adults younger than 20 years who underwent either gastric bypass or gastroplasty (91). A follow-up report in 1980 by Anderson, Soper, and Scott described 30 adolescents and young adults younger than 20 years with gastric bypass or gastroplasty (92). Average weight loss was approximately 40 kilograms at 3 years and 26 kilograms at 5 years postoperatively. Recent technical improvements in bariatric surgery may enable greater and more sustained weight loss. In a recent long-term follow-up of 10 adolescents with gastric bypass, satisfactory weight loss was achieved in nine. Long-term data show that the majority of adolescents maintain weight loss for as long as 10 years. Average weight loss was in excess of 50 kilograms, which represented approximately 60% of the initial excess weight. Weight loss was associated with significant improvement in sleep apnea, hypertension and quality of life. Side effects included gallstones, adhesions, abdominal-wall hernia, micronutrient deficiency (i.e., folate, B12, fat-soluble vitamins, iron), and anemia. In other studies, no major postoperative complications were reported and 85% of patients reported being happy with the decision for surgery (93).

As in adults, a multidisciplinary team with medical, surgical, nutritional and psychological expertise carefully selects adolescents for gastric bypass. All severely obese children more than 100% above ideal body weight are first provided the opportunity to lose weight through a family-based dietary and behavioral program as recommended by the Expert Committee on Obesity Evaluation and Treatment. Until more data are available in children, gastric bypass surgery should be considered only for well-informed and motivated adolescents who meet the following criteria: severe obesity (BMI ≥40), failure of ≥6 months of organized attempts at weight loss, near-complete skeletal maturity and significant comorbidities that would be responsive to sustained weight loss (94). Extensive counseling, education and support are required both before and after gastric bypass. Only a surgeon with extensive experience with bariatric surgery should perform gastric bypass surgery. Finally, adolescents undergoing gastric bypass require lifelong medical and nutritional surveillance, especially during pregnancy.

Emotional Support. Few problems in childhood have as significant an impact on emotional development as being overweight. Monello and Mayer observed that overweight girls often have expectations of rejection and may experience progressive social withdrawal (95). Overweight adolescents have a significantly higher prevalence of depressive symptoms (96) and lower self-esteem (97–100). In addition, decreasing levels of self-esteem in adolescent overweight children are associated with higher rates of loneliness, sadness and nervousness (101). There is strong indirect evidence that overweight adolescents are stigmatized. Studies of children as young as 6 years consistently reveal that overweight individuals are most likely to be described in harshly derogatory terms (102,103). Richardson et al.'s studies in the 1960s

demonstrate that overweight children are uniformly ranked by other children as the least-desirable friends (104). Studies demonstrate that many overweight adolescent boys and girls are socially marginalized, have fewer friends and have impaired quality of life when compared with normal weight children (100). Nonetheless, increased sports and school club participation and less television viewing may not only increase energy expenditure but also mitigate the social isolation of obese adolescents.

Institution of dietary modification and activity counseling without addressing issues of self-esteem, depression, anger, shame and humiliation may undermine treatment. A child who successfully loses weight will not automatically feel less depressed, make more friends, have better self-esteem or stop arguing with parents. Unanticipated persistence of negative self-feelings may undermine the child's and family's motivation. Therefore, psychological counseling specifically targeting emotional feelings of low self-worth, depression and shame is an essential part of treatment for obese children and adolescents.

Parents can increase a child's self-esteem by giving the child positive, supportive messages that promote learning, decision making and self-confidence. Regular physical activity may also help increase self-esteem (10). A study of adolescents by Page and Tucker (105) demonstrated that those who exercised regularly were more likely to perceive themselves as attractive and report satisfaction with their body weight. Those who exercised infrequently were more likely to suffer from loneliness, shyness and feelings of hopelessness.

Primary Prevention of Childhood Overweight and Obesity

The most logical approach to weight control in childhood is prevention. Until a child enters school, their weight reflects the eating and activity environment provided by parents or other caregivers. While in school, a child can be influenced by what is taught about diet and activity as well as what is offered for meals and exercise. Habits that develop in childhood profoundly influence activities later in life. Although the current environment that promotes high calorie intake and sedentary lifestyle is an important contributor to the obesity rates in the United States, interventions to change that environment will meet many social and financial barriers. At present, prevention of childhood obesity and subsequent persistence of obesity into adulthood may be a more effective means to improve the obesity levels in the United States (106). If the epidemic of childhood overweight and obesity cannot be halted, its full impact will not be felt until current children become adults. It is important to realize that even though obesity in the adult population is at epidemic proportions, when present adults were children the prevalence of overweight in children was less than half of what it is now.

CONCLUSION

The current increase in childhood overweight and obesity reflects the convergence of many biologic, economic and social factors. Body mass index is a quick and easy way to screen for childhood overweight. Although genetic differences may result in subtle differences in metabolism that predispose an individual to becoming overweight or obese, no measurable differences in metabolism can be detected in the majority of obese children. With increasing frequency, serious medical sequelae of overweight have their onset during childhood rather than the adult years. The social and emotional aspects of overweight are immediate and apparent and influence many aspects of child and adolescent well-being independent of their physical health effects.

The solution for the current epidemic of overweight and obesity is prevention. Screening of children for overweight should begin in the first year of life, and primary care practitioners can monitor the nutritional status of children in their practice by calculating and plotting BMI once standing heights are obtained after 2 years of age. Advice should be offered to parents regarding the prevention of overweight as soon as a child begins to cross BMI percentiles and should not be postponed until the child or adolescent is at or above the 95th percentile of BMI for age and gender.

Although the treatment of overweight in children is not simple, fast or invariably successful, controlled studies of obese children have demonstrated good short-term and long-term outcomes (107). Treating childhood overweight relies on positive family support and lifestyle changes involving the whole family. Preconceived notions about dieting and weight loss often confound treatment. Parental and childhood education is, therefore, essential. When the right family dynamics exists—a motivated child with supportive parents—success is possible.

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