

## REVIEW ARTICLE

# CHILDHOOD OBESITY: AN APPROACH TO INDIVIDUALIZED TREATMENT

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## Abstract

In the United States, obesity prevalence has surpassed alarming rates and reached epidemic proportions with increased body mass index and poor diet being among the top causes of morbidity and mortality. Approximately 18.5% of children in the United States have obesity. Childhood obesity is associated with medical conditions such as cardiovascular disease, type 2 diabetes mellitus, asthma and musculoskeletal disorders among other conditions. It is also associated with an increased risk for discrimination and bullying. The goal of treatment in the pediatric and adolescent patient with overweight or obesity is to develop healthy habits and lifestyle patterns which will hopefully persist into adulthood in order to prevent future adverse health outcomes, improve quality of life and improve body image and self-esteem. Osteopathic family physicians are well suited to provide the needed comprehensive care, taking a holistic, patient-centered treatment approach including nutrition, activity and behavior. While therapeutic lifestyle changes are the primary focus of treatment, the provider must also consider socioeconomic factors, mental health, treatment of comorbidities and familial factors when determining treatment. This article aims to summarize the risks and consequences of childhood obesity as well as outline the approach the osteopathic family physician can take to assessment and treatment of the pediatric patient with obesity.

## INTRODUCTION

Childhood obesity is a disease with a multifaceted etiology and numerous individual, environmental, and socioeconomic determinants.<sup>1</sup> In the United States, obesity prevalence rates have reached epidemic proportions with two out of every three adults having overweight or obesity.<sup>2,3</sup> In fact, the average body mass index (BMI) of adults in the United States is approaching the range of obesity.<sup>4</sup> This growing prevalence in recent years is concerning, as increased BMI and poor diet are among the top causes of morbidity and mortality in the United States.<sup>5</sup> Unfortunately, children are not spared from this epidemic. According to the U.S. Centers for Disease Control and Prevention (CDC), as of 2015–2016, 18.5% of children in the United States had obesity—affecting approximately 13.7 million children and adolescents. Obesity rates were found to be 13.9% among those aged 2–5 years old, 18.4% among those aged 6–11 years old and

20.6% among those aged 12–19 years old.<sup>6</sup> This article aims to summarize the risks and consequences of childhood obesity as well as outline the approach the osteopathic family physician can take to assess and treat the pediatric patient with obesity.

## DEFINING OBESITY

Obesity refers to excessive accumulation of body fat and, in adults, is measured based on BMI, which is body weight adjusted for body height measured in kg/m<sup>2</sup>. Normal weight BMI is defined as 18–24.9, overweight 25–29.9, class I obesity 30–34.9, class II obesity 35–39.9 and class III obesity ≥40.7 BMI measurement has long been used as a validated screening tool for overweight and obesity in children and is recommended with a Grade B evidence level by the United States Preventive Services Task Force (USPSTF) for children aged 6 years and older.<sup>8,9</sup> In children, BMI is adjusted based on percentile for age and sex. Normal weight is defined as the 5–84.9 percentile for the child's respective age and sex, overweight as the 85–94.9 percentile, obesity as ≥95 percentile to 120% of the 95th percentile, class II obesity as >120% of 95th percentile and class III as >140% of 95th percentile.<sup>10</sup> While there are some limitations with BMI, and other measures of adiposity exist, BMI is the simplest way to screen for obesity.<sup>11</sup> It should also be noted that there is no accepted definition for obesity in children under 24 months;<sup>12</sup> however, those at risk can be identified using World Health Organization (WHO) weight for length (WFL) charts.<sup>13</sup>

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## CONSEQUENCES

The potential consequences of childhood obesity are many. Childhood obesity has been associated with complications including, but not limited to: cardiovascular disease, type 2 diabetes mellitus, asthma, obstructive sleep apnea, musculoskeletal disorders, nonalcoholic fatty liver disease, attention deficit/hyperactivity disorder, conduct disorder, depression, learning disability, developmental delay and lower executive function.<sup>14-22</sup> Complications related to poor nutrition and lack of exercise have been highlighted during the COVID-19 pandemic, as early studies suggest an increasing rate of type 2 diabetes mellitus among children in the United States.<sup>23,24</sup> Childhood obesity has also been associated with increased risk of cancer and research indicates a particular increase in multiple myeloma, colorectal, uterine corpus, gallbladder, kidney, and pancreatic cancers in young adults who had obesity as children.<sup>25,26</sup> Additionally, children with obesity are at increased risk of discrimination and bullying.<sup>27</sup> To make matters worse, the complications of obesity do not end in childhood. Children and adolescents with obesity are 5 times more likely to have obesity as adults, with around 80% of adolescents with obesity maintaining that status as adults.<sup>28</sup>

## CAUSES AND RISK FACTORS

There are many contributing factors to childhood and adolescent obesity, with genes, behavior and environment all playing roles. Clinicians should pay particular attention to patients with risk factors for developing obesity. Risk factors include obesity in the mother and father, poor nutrition, decreased physical activity, sedentary behavior, poor sleep, increased intake of sugar sweetened beverages, fast food, television in the bedroom and low family income.<sup>29</sup> Clinicians should be mindful of risk factors in younger children as well which can include maternal/gestational diabetes, gestational hypertension, maternal smoking, gestational weight gain, and rapid infant growth.<sup>29,30</sup>

Another risk factor that may not be as obvious to some clinicians is food insecurity. Food insecurity and obesity have long been associated with each other, as they are potential products of socioeconomic disadvantage.<sup>31</sup> The United States Department of Agriculture (USDA) defines food insecurity as reduced quality, variety, or desirability of diet or disrupted eating patterns and reduced food intake.<sup>32</sup> Screening for food insecurity can be done quickly with the 2-item Hunger Vital Sign™ screening tool, which uses a subset of 2 questions from the USDA's Household Food Security Scale.<sup>33</sup> Affirmative answers to either of the questions can help identify food insecurity. With this knowledge, physicians can help direct qualified patients to government resources, such as the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) and the Supplemental Nutrition Assistance Program (SNAP).<sup>34,35</sup>

TABLE 1:

Review of systems<sup>38</sup>

SYSTEM REVIEWED	SYMPTOMS TO ASSESS	POSSIBLE COMORBIDITIES
General	Loud Snoring Daytime sleepiness	Obstructive sleep apnea
	Shorter sleep duration Delayed onset of sleep	Disordered sleep
Respiratory	Shortness of breath Exercise intolerance Wheezing Cough	Asthma
Gastrointestinal	General abdominal pain RUQ or epigastric pain Intermittent or colicky pain	Nonalcoholic fatty liver disease Gallbladder disease Constipation
	Heartburn Dysphagia Chest discomfort	Gastroesophageal reflux
Endocrine	Polyuria Polydipsia Fatigue Nocturia	Type 2 diabetes mellitus
Musculoskeletal	Knee pain Leg bowing	Blount's disease
	Hip pain Groin pain	Slipped capital femoral epiphysis
Psychiatric/ Psychological	Nervousness School Avoidance Social inhibition	Bullying
	Depressed mood Loss of interest/pleasure	Depression
	Worries/fears	Anxiety
	Body dissatisfaction Hyperphagia Binge eating	Eating disorder
Gynecological	Oligomenorrhea Dysfunctional uterine bleeding Hirsutism Acne	Polycystic ovarian syndrome
Skin	Skin pigmentation Skin tags	Insulin resistance
	Rash	Intertrigo

The physical examination of a child with obesity includes a general examination with special attention to certain foci. While a complete history will direct the exam, physicians should pay particular attention to blood pressure and heart rate when evaluating vital signs. Physicians should also note if any of the following are present: acanthosis nigricans, skin tags, acne and hirsutism in pubertal girls, evidence of papilledema on fundoscopic exam, tenderness and/or limited range of motion of joints of the lower extremities, peripheral edema, and examination of the thyroid for possible goiter.<sup>40</sup>

## TREATMENT

The goal of treatment in the pediatric and adolescent patient with overweight or obesity is to develop healthy habits and lifestyle patterns which will hopefully persist into adulthood and prevent future adverse health outcomes, improve quality of life and improve body image and self-esteem.<sup>37</sup> The approach should be patient-centered and comprehensive including nutrition, activity, behavior, and, in some cases, pharmacotherapy and even bariatric surgery. An interdisciplinary team-based approach may work best for some patients.<sup>40</sup> The USPSTF has determined that a comprehensive, team-based approach can be effective, including primary care clinicians, exercise physiologists, physical therapists, dietitians, diet assistants, psychologists and social workers.<sup>9</sup>

Unfortunately, weight bias is quite prevalent in health care, not only in the United States, but also across the globe.<sup>41,42</sup> Worse yet, this bias can have adverse consequences on patient care.<sup>43</sup> Research suggests some physicians spend less time with patients with obesity than other patients.<sup>44</sup> Additionally, studies have found perceived weight stigma can contribute to unhealthy eating behaviors among patients and contribute to exercise avoidance.<sup>45,46</sup> Clinicians should use sensitivity when discussing this diagnosis to avoid embarrassment.<sup>47</sup> Care should be taken to use “patient first” language, such as “person with obesity” rather than “obese person.”<sup>48</sup> Clinicians should avoid terms like “fat” and “obese” as these words have a strong negative connotation and can have a detrimental impact on the patient.<sup>49</sup> Neutral terms like “weight” and “body mass index” are preferred to avoid any embarrassment or shame in the patients and their families.<sup>50</sup> In light of the *21st Century Cures Act*, physicians should also follow this guidance for documentation, not just discussion.<sup>51</sup> Physicians can also help reduce the likelihood of stigmatization by role modeling professional behavior in the office and assuring a welcoming environment for patients of diverse body sizes.<sup>50</sup> One area of the clinical setting where this is easily addressed is the waiting room. The chairs should be able to support a child or parent with a higher body weight, and arm rests that may limit one’s ability to sit comfortably should be avoided.<sup>50</sup> Another facet that can easily be addressed is placement of the scale. A scale should be in a private area and should be capable of weighing a patient with a higher body weight.<sup>50</sup>

Evidence of interventions improving weight bias in healthcare professionals is lacking, and it is likely that more than one strategy is needed to improve this bias.<sup>52</sup> On an individual level there are resources available to those who wish to learn more about implicit weight bias.<sup>50</sup> On a broader level, research has shown that a comprehensive curriculum focused on obesity can improve osteopathic medical students’ attitudes toward and knowledge of obesity.<sup>53</sup> More implementation of obesity and weight bias education into medical school curricula may be of benefit in reducing weight bias in physicians.

A clinician should focus on educating patients, as well as families, and encouraging healthy lifestyles.<sup>18</sup> There is not one specific diet recommended for all children; however, there are some general guidelines that if applied may aid in obesity reduction. Sugar-sweetened beverages, processed foods, fast food, candies, snacks, cakes, animal products, whole milk and refined grains can be associated with higher rates of obesity.<sup>54</sup> Clinicians should advise patients and their parents of these findings to provide general guidance. On the other hand, diets with low levels of sugar and fat and high levels of fruits, vegetables, whole grains, fish, nuts, legumes and yogurt are less associated with obesity.<sup>54</sup>

### Behavioral approaches

Behavioral interventions have been demonstrated to lead to improvement of weight in children and adolescents. In one analysis of interventions targeted to children aged 6 years and older, those that were effective offered education on topics like dietary intake and exercise, delivered behavioral training (ie, goal setting, contingent rewards) and involved a total of 26 contact hours or more. These contact hours took place over the course of 2–12 months in a variety of settings, including group sessions, individual sessions, parent-only, child-only and family sessions.<sup>9</sup> They also commonly targeted both parent and child and included physical activity under supervision.<sup>29,55</sup> Based on these observations, successful behavioral interventions should include education on both physical activity and nutrition, adoption of healthy behaviors through goal-directed change and delivery on a frequent basis over an extended period of time.<sup>9,56</sup>

Effective behavioral interventions should also be personalized and detailed. A healthcare provider should utilize their earlier assessment of the patient’s dietary and physical activity history to identify gaps from what is recommended. In addition, the provider should also identify any barriers that have prevented the patient from reaching a healthy weight in the past, along with determining the readiness of the patient and their family to commit to change.<sup>57</sup> This information can be effectively gleaned through the use of a motivational interview, a communication style in which the provider utilizes questioning to understand and strengthen a patient’s commitment to change.<sup>58</sup>

Physical activity recommendations in children are offered based on the amount of time and level of intensity.<sup>59</sup> Activities to be encouraged should be age-appropriate, emphasize a variety of physical skills and are enjoyed by the child.<sup>60</sup> Activities that develop fundamental movement skills (ie, running, kicking, throwing, catching, jumping, balance) should be prioritized, as those children who are competent are more likely to be physical activity as they become older.<sup>61</sup> Furthermore, the healthcare provider should also focus on reducing the amount of time a child is sedentary—non-academic screen time should be limited and replaced by physical activity when appropriate.<sup>57</sup>

**TABLE 2:**

Physical activity recommendations for children<sup>59</sup>

AGE	ACTIVITY AMOUNT	ACTIVITY INTENSITY*
3–5 years old	> 180 minutes/day	Any intensity, some moderate to vigorous
5–17 years old	>60 minutes/day	Moderate to vigorous intensity; activity type should include bone/muscle strengthening 3 days/week

\*Activity intensity is rated as light, moderate, or vigorous. Light is defined by the metabolic equivalent of the task (MET) < 3 (eg., walking, playing catch). Moderate is defined by MET 3–6 (eg., jogging, yardwork). Vigorous is defined by MET > 6 (eg., running, ice skating, jumping rope).

For children not meeting the recommended level of physical activity, families should be given examples of activities appropriate for age, skill and intensity. The amount of time per day and days per week spent in the activity should be gradually increased in small increments until the recommended amount is achieved.<sup>59</sup>

Dietary recommendations in children and adolescents, referring to calorie intake and diet composition, will differ based on age and gender (the USDA’s Dietary Reference Intake Calculator for Healthcare Professionals can be used to estimate calorie and nutrient needs). Specific exploration of sugar-sweetened beverage intake (ie, soda, fruit drinks, sports drinks) is also encouraged; these beverages are often calorie-dense and contribute added sugars to the diet.<sup>62</sup> If dietary calorie intake is determined to be excessive, consider focusing on specific behaviors which increase calorie intake (eg, avoid drinking soda) as opposed to focusing on calorie limits themselves (eg, consume fewer than 2,000 calories per day).

Both physical activity and dietary intake can be effectively influenced through the use of cognitive behavioral techniques. This approach involves setting achievable goals, tracking behaviors that signify change and then reinforcing those behaviors with non-food rewards; these rewards include verbal praise and expanded privileges.<sup>57</sup> It is important to emphasize that it is the achievement of a behavioral goal that should be rewarded and not weight change itself. Parents should also be encouraged to role-model these same behaviors that may create healthy habits in children.<sup>57</sup> There are several topics which behavioral goals can be structured around; a single topic should be selected for discussion per office visit.<sup>9,56</sup>

**TABLE 3:**

Examples of behavior goals that promote healthy weight<sup>9,56</sup>

BEHAVIORAL GOALS
Eating 5+ fruit/vegetable servings per day
Limiting non-academic screen time to < 1-hour per day
Avoidance of sugar-sweetened beverages
Demonstration of portion control
Use of self-monitoring logs (ie, dietary intake, physical activity, screen time)
Increasing moderate to vigorous physical activity
Limiting take-out/fast food dining
Achieving adequate sleep

Weight targets should be established for the provider to monitor improvement in weight over time. While this weight goal can be shared with patients and their families, providers should be mindful not to prioritize weight change over behavior change. The target for children and adolescents will vary based on age and BMI percentile.<sup>9,56</sup>

**TABLE 4:**

Weight loss goal recommendations<sup>9,56</sup>

BMI	RECOMMENDATION
85th to 94th percentile	Ages 2–18 should maintain weight or have BMI trend downward
95th to 98th percentile	Ages 2–5 should maintain weight or have BMI trend downward Ages 6–11 should lose no more than 1 lb per month Ages 12–18 should lose no more than 2 lb per week
BMI 99th percentile and above	Ages 2–5 should lose no more than 1 lb per month until BMI < 97th percentile Ages 6–18 should lose no more than 2 lb per week

Adherence rates to a behavioral intervention is believed to be a key part of its success.<sup>29,55</sup> Follow-up visits should be scheduled based on the patient’s readiness to change and the counseling being offered. Commonly, visits are scheduled monthly during the initial stages of weight management but may be arranged on a weekly basis in more intensive interventions. Weight targets should be reevaluated every 3–6 months. If progress toward a weight target is not being seen in 6–12 months the patient should be considered for other treatment measures or referral to a weight management specialist. If weight loss is being seen at rates greater than recommended, screening for an eating disorder should occur and the patient referred as appropriate.<sup>9, 56</sup>

**Pharmacotherapy**

When lifestyle modifications and behavioral interventions are not enough to control obesity, medications can be considered as adjunctive therapy. As of now, there are only 3 approved

medications for weight loss in adolescents. Phentermine hydrochloride is approved for children aged 16 years or older, and orlistat and liraglutide are approved for children at least 12 years old.<sup>63-65</sup>

While there are not many pharmacologic options to treat obesity in children, the clinician still plays an important role when it comes to the effect of medication on a patient's weight. Care should be taken to avoid obesogenic medications, if possible, when treating other conditions in pediatric patients with overweight and obesity. The Endocrine Society published guidelines in 2016 with recommendations for pharmacologic treatment of conditions other than obesity to avoid further weight gain due to iatrogenic effects of medications.<sup>66</sup> In a patient with type 2 diabetes mellitus, metformin and GLP-1 agonists are recommended if not contraindicated. Angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs) and calcium channel blockers are preferred over beta-blockers in the treatment of hypertension. Oral contraceptives are recommended over injectable medications due to weight gain with injectables. Nonsteroidal anti-inflammatory drugs and disease-modifying antirheumatic drugs are preferred in patients with chronic inflammatory disease due to the potential weight gain associated with corticosteroids. When antidepressant medication is needed, one should know that tricyclic antidepressants and mirtazapine have been associated with weight gain. Paroxetine is the selective serotonin reuptake inhibitor most associated with weight gain, whereas fluoxetine and sertraline are more likely associated with weight loss. If antipsychotic medication is indicated then ziprasidone and aripiprazole are preferred over olanzapine, quetiapine and risperidone. When considering antiepileptic medications, it should be noted that weight loss may be seen with felbamate, topiramate, and zonisamide whereas gabapentin, pregabalin, valproic acid, vigabatrin, and carbamazepine have been associated with weight gain.<sup>66</sup>

### Bariatric surgery

While bariatric surgery is not well studied in the adolescent population, adolescent patients with obesity along with comorbid conditions who have failed comprehensive behavioral interventions may be candidates for surgical or device therapy. The American Academy of Pediatrics recommends that bariatric surgery be considered in patients with class II obesity (BMI  $\geq 35$ , or 120% of the 95th percentile for age and sex, whichever is lower) with clinically significant comorbid conditions and patient with class III obesity (BMI  $\geq 40$ , or 140% of the 95th percentile for age and sex, whichever is lower).<sup>67</sup> Adolescent patients seeking bariatric surgery face a number of barriers including, but not limited to, lack of insurance approval<sup>68</sup> lack of provider knowledge<sup>69</sup> and access to a tertiary care facility that is prepared to provide bariatric surgical care to the pediatric population.<sup>70</sup>

### OSTEOPATHIC PHILOSOPHY

The osteopathic family physician is particularly well-equipped to treat obesity in the pediatric population. Obesity as a disease impacts multiple organ systems and can affect the psychosocial aspects of a child's life in many ways. By following the tenets of

osteopathic medicine, a physician can ensure a holistic approach to the evaluation and treatment of obesity that addresses the patient's biopsychosocial well-being.<sup>71</sup> From a biomechanical perspective, there is limited research in the use of osteopathic manipulative treatment in this population. However, there is research suggesting the effectiveness of osteopathic manipulative treatment in treating musculoskeletal complaints in adult patients with obesity.<sup>72</sup> Because of greater ligamentous laxity in children that results in an increase in range of motion, tissue and muscle tone assessments become more important in terms of evaluation; a head-to-toe structural exam can be helpful. Somatic findings that may be limiting physical mobility and function should be addressed. Note that as a child becomes older their body will grow and mature, impacting body structure and related function. As a result, structural reevaluation should be performed regularly.<sup>73</sup>

### CONCLUSION

The rate of obesity in children and adolescents has been, and continues to be, on the rise. Preventing and treating obesity in this population requires a comprehensive approach including counseling on healthy diet and exercise, behavioral interventions, possible pharmacotherapy and, in some cases, surgical referral. A team-based approach is recommended including physicians, exercise physiologists, physical therapists, dietitians, diet assistants, psychologists, and social workers. Care should be taken to recognize and avoid any biases and person first language should be used when discussing obesity with patients. Osteopathic family physicians are well suited to provide the needed comprehensive care taking a holistic treatment approach in all patients. Further research is needed on the effects of osteopathic manipulative treatment on pediatric patients with obesity and whether this could be a viable treatment to indirectly aid in weight loss. While therapeutic lifestyle changes are the primary focus of treatment, the provider must also consider socioeconomic factors, mental health, treatment of comorbidities and familial factors when determining treatment.

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