# OBESITY IN CHILDREN: A CASE FOR TENNESSEE

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**Abstract**

Obesity is a chronic condition that affects personal health, morbidity and mortality rates, psychological wellness, and health care costs. There has been a worldwide increase of obesity in children. More than half of adults in the United States are overweight and the incidence of obesity in adolescents has almost tripled in the past 30 years. Obesity has a complex and multi-factorial etiology and a significant economic impact. Obesity predisposes children to cardiovascular disease, Type 2 diabetes, depression, and numerous other conditions. Adult-onset diabetes was renamed to Type 2 diabetes to accommodate the escalating rate of diagnosis in obese children. Thus intervention strategies are indicated and the primary prevention interventions for Tennessee include standardization of data collection, breastfeeding promotion, improved physical activity infrastructure, and education / marketing programmes.

**Key words:**
obesity, children, Tennessee

## Introduction

Obesity is considered a chronic disease that predisposes the individual to a myriad of health disorders. The etiology of obesity is complex and multi-factorial. Body weight is influenced by culture, society, availability and quality of food, the endocrine system, genetic factors, psychological and behavioral components, education level, physical activity, and economic status. The purpose of this paper is to explore the factors influencing obesity in children of Tennessee. For the purposes of this article the following definitions related to obesity will be used: Body Mass Index (BMI) is a number calculated from a person's weight and height. The term BMI is used to describe body weight adjusted for height and is the standard for measuring obesity for adults in the United States. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems. Although, BMI correlates with the amount of body fat, BMI does not directly measure body fat. For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age. BMI is used as a screening tool to identify possible weight problems for children. CDC and the American Academy of Pediatrics (AAP) recommend the use of BMI to screen for overweight children beginning at 2 years old (CDC, 2007).

Overweight. The term overweight is excess adipose tissue that predisposes an individual to disease. Overweight and obese are often used interchangeably in the literature. A BMI of 25 to 29.9 is considered overweight by the American Obesity Association (2008) and children over the 85th percentile are considered overweight (CDC, 2007).

Obesity. Obesity is the excessive accumulation of adipose tissue to an extent that health is impaired. Obesity in adults is defined as a BMI over 30 by the American Obesity Association (AOA, 2008), and any BMI over 25 by other organizations (Kaiser, 2005). Although the term obesity is avoided for children, Pietrobelli et al. (1998) consider children and adolescents above the 95th percentile obese.

## Prevalence Rates of Obesity

The World Health Organization's (WHO) latest projections indicated that globally in 2005, approximately 1.6 billion adults (age 15+) were

overweight, at least 400 million adults were obese, and at least 20 million children under the age of 5 years were overweight. WHO further projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese (2005). Methods that define and measure obesity vary from country to country, but there is a significant trend of increased incidence of obesity in children worldwide (Burniat, Cole, Lissau, & Poskitt, 2002). To date more than 12.5 million or 17.1% children and adolescents, ages 2 to 19 years, are overweight. As they grow older, overweight children and adolescents are more likely to have risk factors associated with cardiovascular disease such as high blood pressure, high cholesterol, and Type 2 diabetes (USDHHS, 2008).

Obesity statistics differ by ethnic group, gender, age, and socioeconomic status. Fifty-nine percent of Caucasian and 68 percent of black adults in Tennessee are obese reflecting an upward nationwide trend (Kaiser, 2005). The prevalence of overweight in Mexican-American and non-Hispanic black girls was higher than among non-Hispanic white girls. Among boys, the prevalence of overweight was significantly higher among Mexican Americans than among either non-Hispanic black or white boys. Among adults, similar differences existed. Approximately 30% of non-Hispanic white adults were obese, and 45.0% of non-Hispanic black adults and 36.8% of Mexican American adults were obese. There were significant differences by age. Adolescents were more likely to be overweight than younger children, and older adults were more likely to be obese than younger adults. The only exception was among adults 80 years and over who were no different than adults 20-39 years of age. Between 1999 and 2004, there was a significant increase in the prevalence of overweight among girls (13.8% in 1999 to 16.0% in 2004). Similarly, among boys, the prevalence increased significantly from 14.0% in 1999 to 18.2% in 2004. The prevalence of obesity among men also increased significantly from 27.5% to 31.1%. There was no change in obesity among women (33.4% in 1999 to 33.2% in 2004) (CDC, 2007).

Caucasian children are less likely to be obese as they go up the socioeconomic scale. There is a similar tendency in ethnic children, but obesity is still more prevalent than in white children (Gordon-Larsen, Adair, & Popkin, 2003). Poor adolescents are twice as likely to be obese as those from middle- or high-income households. African American and Mexican children are becoming obese at a faster rate than Caucasian children (ODPHP, 2001). Low socioeconomic status and lack of parental education are significantly correlated to childhood obesity (Mustillo et al., 2003).

**Etiology of Obesity**

There are many possible causes of the increased obesity rates. It is difficult to single out one factor, but it is known that age, race, socioeconomic levels, parent behavior, educational levels, geographical location, and gender all are significant. Obesity has a complex multi-variable etiology but is essentially a preventable disease. The principle causes of the problem have been identified as sedentary lifestyle coupled with a high-fat, high-calorie diet (WHO, 2005).

The choice to breast or bottle-feed has a direct influence on the development of eating habits. Breastfed babies eat to satisfy their needs and the mother is not tempted to "finish off the bottle" but rather stops when the baby stops. The bottle-feeding mother assumes more active control of when feedings stop and may overfeed the baby. The baby may not learn to self-regulate appetite and satiety. The risk of obesity in adolescence is lower for babies who were breastfed 6 months or longer (Mayer-Davis, et al., 2006).

Epidemiological research has indicated that fat intake in early life increases the risk for obesity and concurrent associated diseases in adulthood (Klesges, & Klesges, 1995). Overweight children become overweight adults (Fierro, 2002). Children of obese parents have a higher risk for obesity (Klesges & Klesges, 1995). Parents provide the food and demonstrate the norms of eating including variety, portion amount, patterns, frequency of food intake, and dieting behaviors (Thompson & Smolak, 2001).

Eating out is no longer an occasional indulgence. Low-nutrient, calorie-dense food becomes a fast, convenient, and inexpensive option for busy working parents. Guthrie, Lin, and Frazao (2002) in a twenty year longitudinal study found that

Americans are eating almost half of their meals outside the home, are eating more calories in fat, and are receiving less fiber, calcium, and iron. The trend to eat out is not expected to decrease. Adolescents in grades seven through ten seldom order milk when eating out (National Dairy Council, 2003).

American children consume less calcium rich dairy products. There is a significant gap between recommended daily intake and actual consumption (National Dairy Council, 2003). Calcium from dairy sources is an appropriate nutrient-dense choice, especially when low fat products are chosen. Increased intake of calcium is associated with reduced body fat and less weight gain over time (Carruth & Skinner, 2001). Consumption of soft drinks and sweetened fruit drinks has increased. These nutrient-deficient high-calorie fluids have replaced milk for many American children. The change in beverage habits has coincided with the trend for obesity suggesting at least a contributory relationship (Ludwig, Peterson, & Gortmaker, 2001).

The nation faces a complex challenge in addressing recent trends in children's health and eating habits. To address these trends, in 2001, the U.S. Surgeon General issued a call to action to prevent and decrease overweight and obesity among all Americans, especially children. In this statement, schools were identified as one of the key settings for public health strategies to address these issues. The National School Lunch and School Breakfast Programs provide millions of children with nutritious meals each school day. The United States Department of Agriculture's (USDA) Food and Nutrition Service (FNS) administers these programs at the federal level, and FNS subsidizes the meals served through these programs in local schools as long as the meals meet certain nutritional guidelines. In the last decade, these nutritional guidelines were amended to require schools to serve meals that adhere to the Dietary Guidelines for Americans, which limit total and saturated fat and provide specific minimum levels of vitamins and nutrients. Despite these efforts to improve the nutritional quality of meals offered through the school meal programs, other foods not provided through these programs are often available to children at school through a la carte lines in the cafeteria where individual foods and beverages can be purchased, snack shops, school stores, vending machines, and other venues (GAO, 2004).

Seventy five percent of Tennessee elementary schools have vending machines; the numbers for high schools are higher (Tarr, 2003). The control of what is in the vending machines, where they are placed, and when they are available to students is the jurisdiction of the school administration. School meals must meet minimum nutrition standards, but foods sold in vending machines, usually adjacent to the cafeteria, are not regulated by the USDA. The revenues from vending machines are used to assist with under-funded academic programs. High-calorie low-nutrient foods in vending machines compete with school meals and impair the effectiveness of the nutrition program (USDA, 2001).

The types of fats and sugars in the American diet have changed. Palm oil is an inexpensive stable fat that does not easily go rancid, but has taste and chemical properties similar to animal fat. Palm oil, however, is a highly saturated fat, making it less healthy than vegetable oils and even some animal fats (Edam, 2002). The choice to use palm oil (especially commercial use for prepared foods) over other low in saturated fat vegetable oils enhanced U.S. trade with Malaysia (Critser, 2003). Saturated fats predispose individuals to coronary artery disease and cardiovascular disorders. Oxidized palm oil increases plasma lipid levels and damages the tissue of the kidneys, lungs, heart and liver (Ebong, Owu, & Isong, 1999).

The 1970's saw an increase in the use of High Fructose Corn Syrup (HFCS) as an inexpensive domestic-produced sweetener for cola products and other high calorie snack foods (USDA, 2003). HFCS is six times sweeter than the sucrose in sugar cane. Corn is easy to grow in the United States, and its planting was heavily promoted by the U.S. Department of Agriculture to take advantage of the HFCS demand (Critser, 2003). Fructose, however, metabolizes differently than sucrose or dextrose. Fructose goes straight to the liver without breaking down. This impairs liver function and significantly contributes to obesity, insulin resistance, Type 2 diabetes, and high

triglyceride levels (Bantle, Raatz, Thomas, & Georgopoulos, 2000).

American children are less physically active. Children tend to ride the bus or are driven to school by parents (Fierro, 2002). Increased television watching keeps them sedentary while sophisticated marketing strategies tempt even more high-calorie consumption. Video games have replaced playing outside. There is a lack of safe, supervised playgrounds. Twenty five percent of adolescents never participate in any vigorous physical activity. Physical education classes are not offered to all students in Tennessee and frequently offered for only a six-week block in the school semester. There is no federal standard for physical education. State and local boards of education decide, based on budgets, the extent of physical education curriculum and standards in schools. Tennessee has no statute that mandates physical education in schools (National Conference of State Legislatures, 2006).

**Health Risks of Obesity**

Obesity contributes to preventable disease and death and reduces the quality of life (ODPHP, 2000). Obesity contributes to metabolic syndrome, cardiovascular disease, diabetes, pulmonary disease, and various psychological disorders. Endocrinologists are reporting children as young as five years old diagnosed with Type 2 diabetes, high cholesterol, coronary artery disease, and hypertension (Diabetes Week, 2003).

Cardiovascular disease. Diets high in fat lead to hyperlipidemia. High levels of lipids in blood (including cholesterol, triglycerides, low density lipoproteins) lead to cardiovascular diseases such as arteriosclerosis, hypertension, and stroke. Van horn et al. (2003) found obese children with juvenile hypertension to have increased platelet aggregation, which contributes to further hypertension and vascular damage. Obese children have higher blood cholesterol levels that predispose them to arteriosclerosis. Abnormal platelet coagulation further predisposes obese children to thrombus, stroke, and other life threatening conditions. Obese adolescents have higher levels of triglycerides. Incidence of hypertension in obese adolescents is nine times that of the normal weight cohort (CDC, 2007).

Diabetes. The incidence of type 2 diabetes in children and adolescents is a public health epidemic and has increased concurrently with obesity (Aye & Levitsky, 2003). There has been a 1,000% increase in the number of children with type 2 diabetes in the past five years (Fierro, 2002). Two to four percent of all diabetes reported in children before 1992 was type 2 diabetes. This percentage rose to 16% by 1994 (USDA, 2001). Type 2 diabetes currently comprises as much as 45% of the total population of diabetic children and adolescents (Aye & Levitsky, 2003). Obesity complicates treatment for Type 2 diabetes by impairing insulin and glucose management, and by interfering with therapeutic medications (AOA, 2008). Prepubertal obese children show evidence of hyperinsulinemia and insulin resistance, and benefit from weight loss before the onset of puberty (Galli-Tsinopoulou, Karamouzis, & Nousia-Arvanitakis, 2003).

Pulmonary disease. Obese inner-city children with asthma use bronchodilators and other asthma medication more than non-obese children. While the connection between asthma and obesity needs further research, obese children have more wheezing symptomology and emergency room visits (Belamarich et al., 2000). Reduction in pulmonary function, including reduced functional residual capacity, diffusion, and static lung volume, is correlated to obesity in children (Li et al., 2003). Obese children are more likely to suffer breathing interference during sleep. Sleep apnea and snoring reduce oxygen levels, can lead to ventricular hypertrophy of the heart, and at the very least impairs the sleep cycle (CDC, 2007).

Other problems of obesity. Nonalcoholic steatohepatitis, a fatty degeneration of the liver, was previously a rare disorder most commonly found in obese diabetic women over forty years of age. Steatohepatitis, treatable only by liver transplant, is being found in obese children. Obesity, hyperinsulinemia, and glucose intolerance contribute to the development of this expensive and life threatening disease (CDC, 2007).

Immune response, specifically proinflammatory cytokine interleukin-6, is exaggerated in obese children aged 8 to 16 years, which induces a low-grade systemic inflammatory response that can

lead to immune system exhaustion (Visser, Bouter, McQuillian, Werner, & Harris, 2001). Those who are obese have reduced ability to respond to invading pathogens (CDC, 2007). Orthopedic problems of the lower legs and feet are common in obese children. Metabolic syndrome, caused by obesity, improper nutrition, and reduced physical activity, involves insulin resistance and cardiovascular arteriosclerosis. Incidence of metabolic syndrome in obese adolescents is estimated to be as high as 30 percent (Blackburn & Bevis, 2002).

Psychosocial Issues. There are widespread psychological complications of obesity that include emotional, social, and self-esteem issues. Obese children are often teased and are unable to keep up with their peers. They cannot participate in sports, and live in anticipatory fear of ostracism. Severely obese children have a lowered health-related quality of life than normal weight children, and are comparable to children who have been diagnosed with cancer (Schwimmer, Burwinkle, & Varni, 2003). Obesity is a risk factor for the development of bulimia and other eating disorders. Depression, hyperkinesias, anxiety, conduct disorder, ADHD, substance abuse, and oppositional defiant disorder have been associated with obesity in children, even though causality has not been established. (Mustillo et al., 2003).

**Economic impact of obesity**

Obesity costs exceed the cost of tobacco use. Tennessee has the 9th highest level of adult obesity in the nation at 25%, the 2nd highest overweight high school student level at 15.2 %, and the 31st overweight level for low-income children ages 2-5 at 11.3%. The state spent an estimated $315 per person in 2003 on medical-costs related to obesity, which was the 6th highest amount in the nation. Nearly 119 million American adults, 65% of the population, are currently overweight or obese. The direct and indirect costs of obesity in America are more than $117 billion per year. A study conducted by Trust for Americas Health (TFAH) concluded that America does not have the aggressive, coordinated national and state strategies needed to address the crisis, compounding the epidemic (TFAH, 2008).

**Interventions**

The complex etiology of childhood obesity suggests multi-approach intervention strategies. It is difficult to lose weight; the process is more complicated in children who need the nutrients for current growth. Treatment is expensive, must be individually tailored for each child, involve the entire family, and is not effective in many populations. The rebound of adiposity is significant; a cure is not possible. Primary prevention is the appropriate approach once modifiable determinants of obesity are identified (Klesges & Klesges, 1995). Tables 1-5 focus on interventions including support, encouragement, diet, and physical activity that should be incorporated to combat the epidemic of obesity in children in Tennessee (WIN, 2008).

**Table 1: Encourage Healthy Eating Habits**

- Buy and serve more fruits and vegetables (fresh, frozen, canned, or dried). Let your child choose them at the store.
- Buy fewer soft drinks and high-fat or high-calorie snack foods like chips, cookies, and candy. These snacks may be OK once in a while, but always keep healthy snack foods on hand. Offer the healthy snacks more often at snack times
- Make sure your child eats breakfast every day. Breakfast may provide your child with the energy he or she needs to listen and learn in school. Skipping breakfast can leave your child hungry, tired, and looking for less healthy foods later in the day.
- Eat fast food less often. When you do visit a fast food restaurant, encourage your family to choose the healthier options, such as salads with low-fat dressing or small sandwiches without cheese or mayonnaise.
- Offer your child water or low-fat milk more often than fruit juice. Low-fat milk and milk products are important for your child's development. One hundred percent fruit juice is a healthy choice but is high in calories.
- Limit the amount of saturated and trans fats in your family's diet. Instead, obtain most of your fats from sources such as fish, vegetable oils, nuts, and seeds.

- Plan healthy meals and eat together as a family. Eating together at meal times helps children learn to enjoy a variety of foods.
- Do not get discouraged if your child will not eat a new food the first time it is served. Some kids will need to have a new food served to them 10 times or more before they will eat it.
- Try not to use food as a reward when encouraging kids to eat. Promising dessert to a child for eating vegetables, for example, sends the message that vegetables are less valuable than dessert. Kids learn to dislike foods they think are less valuable.
- Start with small servings and let your child ask for more if he or she is still hungry. It is up to you to provide your child with healthy meals and snacks, but your child should be allowed to choose how much food he or she will eat.
- Be aware that some high-fat or high-sugar foods and beverages may be strongly marketed to kids. Usually these products are associated with cartoon characters, offer free toys, and come in bright packages. Talk with your child about the importance of fruits, vegetables, whole grains, and other healthy foods-even if these foods are not often advertised on TV or in stores.

Weight-control Information Network (WIN). (2008).

**Table 2: Encourage Daily Physical Activity**

Like adults, kids need daily physical activity. Here are some ways to help your child move every day:

- Set a good example. If your child sees that you are physically active and that you have fun doing it, he or she is more likely to be active throughout life.
- Encourage your child to join a sports team or class, such as soccer, dance, basketball, or gymnastics at school or at your local community or recreation center.
- Be sensitive to your child's needs. If your child feels uncomfortable participating in activities like sports, help him or her find physical activities that are fun and not embarrassing, such as playing tag with friends or siblings, jumping rope, or dancing to his or her favorite music.
- Be active together as a family. Assign active chores such as making the beds, washing the car, or vacuuming. Plan active outings such as a trip to the zoo, a family bike ride, or a walk through a local park.

A pre-adolescent child's body is not ready for adult-style physical activity. Do not encourage your child to participate in activities such as long jogs, using an exercise bike or treadmill, or lifting heavy weights. FUN physical activities that kids choose to do on their own are often best.

Kids need about 60 minutes of physical activity a day, but this does not have to happen all at once. Several short 10- or even 5-minute periods of activity throughout the day are just as good. If your children are not used to being active, encourage them to start with what they can do and build up to 60 minutes a day.

Weight-control Information Network (WIN). (2008).

**Table 3: Discourage Inactive Pastimes**

- Set limits on the amount of time your family spends watching TV, playing video games, and being on the computer.
- Help your child find FUN things to do besides watching TV, like acting out favorite books or stories, or doing a family art project. Your child may find that creative play is more interesting than TV. · Encourage your child to get up and move during commercials and discourage snacking when the TV is on.

Weight-control Information Network (WIN). (2008).

**Table 4: Be a Positive Role Model**

- Children are good learners and they often mimic what they see. Choose healthy foods and active pastimes for yourself. Your children will learn to follow healthy habits that last a lifetime.

Weight-control Information Network (WIN). (2008).

**Table 5: Be Supportive**

- Tell your child that he or she is loved, special, and important. Children's feelings about themselves are often based on how they think their parents feel about them.
- Accept your child at any weight. Children are more likely to accept and feel good about themselves when their parents accept them.
- Listen to your child's concerns about his or her weight. Overweight children probably know better than anyone else that they have a weight problem. They need support, understanding, and encouragement from parents.

## Conclusion

It is evident from the review that obesity is a challenge for children in Tennessee. The costs of childhood obesity go beyond the dollars spent to diagnose or treat obesity and its related sequelae. The quality of life, prejudices to be endured, and related self-esteem issues for 15% of American children force childhood obesity to the attention of the community and Tennessee is not excluded. Weight loss is never easy, change of lifestyle and behavior are difficult. Weight loss in children is complex and cannot interfere with nutrient requirements for growth. Primary prevention interventions at an epidemiological level need funding, accurate data collection of prevalence rates, and implementation and evaluation of programs. Reversing this epidemic will require increased education and awareness of those who make decisions on behalf of American children and application of psychological behavior change principles for prevention. It is important to note that although this paper focuses on the case of Tennessee, these problems are not unique to this community.

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