

Pediatric Obesity in the United States

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Abstract:

Our society today is vastly different from what it was in the past, especially in terms of healthcare. Numerous advancements and improvements have been made in medicine. As a result, many conditions and diseases that were deemed as dangerous or even deadly previously, are no longer considered a threat. While our progress cannot be overlooked, we also cannot undermine the severity of the new issues we are being introduced to that haven't plagued society in the past. While infectious diseases may no longer be the leading cause of death in America, there are several other conditions that can drastically jeopardize one's health, including pediatric obesity. Pediatric obesity is defined as being in or above the 95th percentile on the Body Mass Index or BMI. The BMI measures the proportion of someone's body fat to their height and weight. It then compares that ratio with others who are within the same sex and age cohort.

In the Western world, pediatric obesity is becoming an increasingly significant and relevant issue. This review paper will look at several aspects that influence and contribute to one's risk of developing obesity during childhood. These risk factors include issues and imbalances in diet (for both the child and mother during pregnancy), genetics, screen time, and financial status. This paper will also describe various health complications that could develop in adulthood including diabetes and heart disease. Additionally, many intervention programs have been implemented to help prevent the youth from becoming overweight or obese. These programs inform the youth about the importance of nutrition as well as the benefits of having a balanced diet and aim to persuade adolescents to maintain healthy habits. This article will highlight some of the interventional programs that have been instituted on both the state and national scale.

Introduction:

Global child obesity rates have skyrocketed in recent years, especially in the Western world. [1] One of the most significant increases in obesity rates can be seen in the United States, which has become one of the leading countries in obesity. As of right now, the United States is ranked within the top 15 countries with the highest obesity rates with about 1 in 5 children in the United States being obese. [1, 2] Additionally, the prevalence of child obesity in both boys and girls in the United States has increased by 50% from 1988-2009. [3]

There are 2 different charts used to measure vertical growth in the United States: The World Health Organization Growth (WHO) Charts and the Centers for Disease Control Growth (CDC) Charts. WHO Growth Charts are for kids 0-2 years old and are split into male and female categories. They consider both the height of the child, the weight of the child, and the head circumference of the child. And, the CDC Growth Charts are for children 2-20 years old and are also divided into male and female sections. This chart measures a child's height and weight and compares this to other children in the United States who fall into the same sex and age category. Body Mass Index (BMI) is only considered in the CDC growth charts when a child has surpassed the age of 2. The BMI measures the proportion of someone's body fat to their height and weight. It then compares that ratio with others who are within the same sex and age cohort.

[4] It is important to know that there are multiple classifications for obesity, which can be denoted using the Body Mass Index or BMI. The CDC has stated that anyone at or above the 95 percentile or greater in BMI is obese. Severe obesity is when someone is 120% of the 95 percentile of BMI. Class 2 Obesity is when someone is between 120% and 140% of the 95 percentile. And, Class 3 Obesity is when someone is over 140% of the 95 percentile. [5]

Risk Factors:

Child's Dietary Intake:

One of the most significant contributors to child obesity is diet. Children who consume more processed foods with higher calorie counts are more likely to become obese because their quality of diet can impact the hormonal and neurological pathways that affect their satiety. [6] When a group of scientists studied the relationship between diet and obesity, they noted that there was a direct correlation between the two. [7] Researchers accessed the dietary patterns of children who were underweight, normal weight, overweight, and obese. The data reported that about 65% of the children who were obese only consumed fruits and vegetables about 1 time every week, while children with normal weight consumed them anywhere from 2 to 6 times per week. [7] When considering legumes, whole grain foods, or milk products, there wasn't a noticeable difference in consumption. [7] However, when considering animal protein, over 20% of obese children consumed this daily, in comparison to an 8.2% daily consumption rate in normal-weight kids and 2% in underweight kids. [7] Finally, when considering sweets, just over 20% of children who were overweight or obese consumed these foods daily compared to under 15% of normal-weight kids. [7] Overall, on average, obese children consumed less fruits and vegetables and more animal protein and sweets compared to normal weight children. The trend between the consumption of these foods highlights the differences in diet between children who are overweight or obese and children who are normal weight.

Maternal Dietary Intake:

While diet has a significant impact on child obesity, maternal food intake during pregnancy also affects a child's likelihood of becoming obese. When a group of pregnant nurses, aged between 25 and 42 years old, were studied, there was a noticeable difference in weight between their children postpartum. [8] The study sorted each mother's intake into 5 consumption groups. The lowest group was unprocessed or minimally processed foods such as foods that have been frozen or ground, and the highest consumption group was ultra-processed foods, including foods such as soda or ice cream. [8] From there, participants were asked to self record their weight and height wearing light clothing to help minimize the impact of clothing on the weight. This data was compared to the averages for children within the same age and gender cohort. This study controlled for both maternal and offspring risk factors that are known to impact obesity. [8] The children of the mothers within the ultra-processed foods consumption group were at a 26% higher risk of becoming either overweight or obese compared to their peers whose mothers consumed minimally processed foods. [8]

To further support this, another study also researched the relationship between maternal nutrition and child health, regarding obesity. The study surveyed just under 400 pregnant women over their dietary patterns while they were pregnant. [9] They assessed the results using the latent class analysis or LCA, which is essentially a statistical analysis that groups data into categories based on shared characteristics between data trends. [10] From there, the study

recognized three dietary classes beginning to form. Latent Class 1 included foods such as fruits, vegetables, sweet/salty snacks, and soda. Latent Class 2 included fruits, vegetables, grains, and water. [9] And, Latent Class 3 included processed meats, fried chicken, french fries, and Vitamin C-rich drinks. The study revealed that mothers consuming foods classified under Latent Class 3 tended to be at a higher risk of having an overweight or obese child by the age of 3 years old, compared to the other latent classes. [9] To conclude, maternal food intake does play a role in child obesity.

Genetics:

From our looks to our blood type, genetics affects many different aspects of our lives. This brings us to the question, is there a genetic component to pediatric obesity? When normal-weight, low-income preschoolers were studied, researchers noticed a 9% higher chance of them becoming obese within the next 3 years, if they had a parent who was also obese. [11] To reduce error, the study also accounted for several other factors including physical activity, food security, and parental depression.

Additionally, another paper researched the idea of hereditary obesity. One gene that was discussed in the study was the fat mass and obesity gene, also known as the FTO gene. [12] The FTO gene has been studied for many decades, however, this gene's link to obesity has only begun to be explored. The FTO gene is a common gene variation that can be found in people from many different races. The primary function of the FTO gene is to monitor satiety and energy metabolism. [12] Having a complete FTO deficiency can lead to autosomal-recessive lethal syndromes such as growth retardation and premature death, proving that the FTO gene is vital for normal growth of a human's central nervous system and cardiovascular systems. [12] In humans, the loss of one functional copy of the gene did not correlate to a specific phenotype. However, when tested on mice, complete or partial inactivation of the gene protected one from obesity. [12] And, the over-expression of FTO stimulates an increase in food intake, resulting in obesity. This study demonstrates a correlation between the FTO gene and developing obesity. [12] However because the study was conducted on mice, further research will be needed to establish a clear connection between this gene and obesity in humans.

Another study conducted similar research with another gene called the melanocortin 4 receptor or MC4R gene. [13] This gene is primarily found in the hypothalamus and controls appetite as well as satiety. Because of this, MC4R genes have been correlated to feeding behavior and regulation of metabolism, among other functions. The first mentions of this gene were in the late 1990s, and now that more research has been conducted, scientists have been able to determine that carriers of the MC4R gene have pathogenic variants that can increase their susceptibility to developing obesity by 450%. [13] This same study reported that in 1998, those with this gene were associated with obesity that was inherited. [13] However, it is important to note that the prevalence of this gene ranges from 0.5%-8.5% in adults and children. [13] Therefore, this study, along with the one mentioned above, supports the idea that, even though it is rare, there is a hereditary component to obesity.

Screen Time:

The youth is growing more dependent on technology day by day. This has led them to spend more time on screens and less time getting the physical activity that their bodies need. In

2022, the CDC reported that less than 25% of kids ages 6 through 17 are completing the daily recommended amount of physical activity of 1 hour. [14]

Screen time is a major component of a sedentary lifestyle. Generally speaking, increased screen time rates have been linked to a greater chance of having or developing child obesity. [16] A group of researchers noticed the upward trend in both screen time and childhood obesity and chose to study it. Their study compared the BMI gain rates of 2 schools located in California. [16] One school received a 7-month long, screen time reduction program, aiming to reduce unnecessary time spent on screens, while the other didn't. By the end of the study, there was a noticeable difference between the BMI gain rates of the students at each school. The students who completed the reduction program were found to have slower BMI gain rates and lower screen time. [16]

Additionally, children who spend more time online typically eat fewer fruits and vegetables compared to others with lower screen times. [16] Instead, these kids consume more processed and energy-dense foods along with fast foods. [16] This is attributed to all the advertisements that glamorize unhealthy foods and specifically target children.

Low-Income Households:

Another strong correlation is between household income and diet. Going back to the article referenced in the "Hereditary" section of this article, it is also important to note that these preschoolers all came from low income backgrounds and were more likely to consume fast food or processed food. Low-income households purchased 29% more fast food meals than middle-class households as they are more affordable. [17] But, regardless of price, fast food usually consists of multiple artificial and synthetic ingredients, which makes it calorically dense and nutritionally barren. Additionally, these foods contain high salt levels and high volumes of high fructose corn syrup. All of these added ingredients make fast foods addictive, however, eating them daily can cause higher blood pressure and microvascular hemorrhaging which could potentially lead to a hemorrhagic stroke. [17]

Effects on Health:

About 75% of children who are obese remain obese in adulthood. [18] Unfortunately, child obesity can lead to several further health complications later in adulthood, both physical and psychological.

Physical Health Effects:

Being obese increases one's chance of developing **diabetes**. Children who are obese are four times more susceptible to developing type-2 diabetes compared to children with a normal BMI. [19] This is because both type 2 diabetes and obesity relate to insulin resistance. Insulin is a hormone produced by the pancreas that helps supply sugar to the rest of the body. [20] After your cells stop responding to insulin, you have developed insulin resistance. Obesity and insulin are closely linked because obesity is the most significant factor contributing to the development of metabolic diseases (diseases and disorders that interfere with normal metabolism). Normal metabolism is the process of converting food to energy in cells. [21] The release of nonesterified fatty acids or NEFA's is associated with insulin resistance. This is because after the production of plasma NEFA's increases, insulin resistance begins to develop



and become more apparent. [22] Additionally, body fat distribution is an extremely important factor when it comes to insulin sensitivity. Insulin sensitivity is essentially when one's body reacts poorly to insulin and has a difficult time absorbing the sugar in the bloodstream. [23] And, it varies in thinner individuals due to the differences in body fat distribution. Those with higher concentrations of fat distribution, especially in areas such as the abdomen or chest, have a higher insulin sensitivity level. [22] These differences in the distribution of adipose, or fat, tissue explain the key differences between intra-abdominal fat and subcutaneous fat. Generally speaking, intra-abdominal fat is tied to the genes that secrete proteins that produce energy and is more lipolytic, or able to break down fat, when compared to subcutaneous fat. This is what makes it more important in regards to insulin resistance and diabetes. [22] And, this process is what can lead to the development of type 2 diabetes.

Another health complication that may arise is **cardiovascular disease**, which is a term used to describe heart diseases and conditions. As of right now, cardiovascular disease is the leading cause of death in the United States, amassing a total of nearly 700,000 deaths each year. [24] And, as of right now, childhood obesity is the most consistent predictor of adult heart disease. [25] Cardiovascular disease is extremely serious as it can be fatal. Data that has been collected in the last few years has indicated that atherosclerotic cardiovascular disease (CVD) processes typically start early in childhood and are influenced by many factors, one being obesity. [25] After one surpasses the 85th percentile, their risk of developing cardiovascular disease drastically increase due to the excess fat buildup within your heart's arteries. [25]

Psychological Health Effects:

While obesity has clearly measurable effects on physical health, it can also affect one's psychological health. One psychological health effect that child obesity can cause is **social isolation**. [26] In fact, studies have shown that factors including media pressure and social norms can make those with obesity feel like they are isolated from the rest of society. [26] This feeling is especially prominent in women who are obese. [26]

Another mental health impact that can stem from childhood obesity is **body dissatisfaction**. Children with obesity are more likely to experience bullying from their peers. [19] Being exposed to this negativity at a young age can damage one's perception of self and can lead one to believe that they need to change themselves to satisfy others. This feeling of unworthiness is what triggers body dissatisfaction, which can lead to depression if not addressed. [19] Studies have shown that those with higher than average BMI are more likely to develop depression. [19]

The final psychological impact this paper will discuss is the development of **eating disorders**. Studies have shown that those with obesity have a higher chance of developing eating disorders, specifically binge eating disorder as well as bulimia nervosa. [27] Those with binge eating disorder will undergo three or more of the following symptoms: eating faster than what would be considered normal, feeling extremely full, overeating, eating alone due to feelings of being embarrassed, and feeling guilt after completing a binge eating session. [27] Bulimia nervosa can be self-evaluated by assessing body weight, body type, continuous binge eating, and/or the intentional prevention of weight gain (through the use of self-caused vomiting or the

misuse of medications). [27] People with obesity are more likely to suffer from these conditions due to feelings of unworthiness, which were discussed at the beginning of this section.

Interventions/ Prevention:

Interventions:

One of the largest child obesity intervention initiatives in the US is the Regional Nutrition Education and Obesity Prevention Centers of Excellence, or RNECE. The primary goal of the RNECE is to improve the health of Americans who are categorized as low-income by promoting affordable and wholesome food options. [28] Additionally, they have four primary subgoals: strengthen the current evidence base, evaluate the long-term effectiveness of nutrition education, build research relationships, and improve nutrition education and obesity prevention. [28]

Another American intervention program was a randomized clinical trial in Nashville, Tennessee. [29] The trial studied over 600 pairs of parents and their children (who were between the ages of 3-5 years old). Over the course of 3 months, a portion of the participants served as the control and continued living their regular lifestyles, while the remainder of them attended 6 school-readiness sessions regarding dietary intake. [29] At the end of the program, the children in the group that attended the readiness sessions consumed about 100 calories less each day in comparison to their peers who didn't attend the meetings. [29] This proves the importance of nutrition education and demonstrates the impact it can have on the youth.

Prevention:

Although this may be obvious, exercise is a great way to prevent developing obesity. The CDC recommends getting at least one hour of physical activity every day. And, as stated earlier, under a quarter of kids in the United States between the ages of 6 and 17 are completing this. [14] In fact, a study performed by Selda Bülbül reported that children who exercised more frequently began to pay closer attention to their diets as well. [30, 31] So overall, participating in some form of physical activity every day, especially as a child, helps prevent childhood obesity, and helps one build healthy habits that prevent obesity during adulthood as well.

Another method that has proven to be very effective is to simply eat healthier foods. [32] Instead of eating foods with higher caloric values, choose a healthier alternative. By restricting your intake of unhealthy foods, and increasing your consumption of healthier foods, you are providing your body the nutrition it needs. [32] This is an especially good habit to have in bodies that are still growing and developing since it models and promotes healthy eating behavior. [32] Nutrition education helps children develop an awareness of good nutrition and healthy eating habits that will last a lifetime. [32]

Discussion:

This literature review seeks to demonstrate that obesity is a multifaceted disorder that can be impacted by a wide range of factors, such as food habits, genetics, and screen time. Regarding dietary impacts on child obesity, research shows that those who consumed more highly processed foods or foods and had a higher caloric intake, were more likely to become obese. After that, the paper discussed how maternal intake can influence a child's chance of becoming obese. From there, the article evaluated the hereditary aspect of obesity. And then,



the paper touched on how having a higher screen time can influence one's risk of becoming either overweight or obese. Following that, it elaborated on how low-income households are more likely to become obese due to the financial limitations on the foods they consume. After discussing the risk factors detailed above, the article explored some of the health effects childhood obesity can have on someone throughout their life. It touched on physical effects, such as diabetes and cardiovascular disease, as well as psychological effects, like body dissatisfaction and eating disorders. And finally, the paper wrapped up by explaining several health interventions in place to prevent the instance of childhood obesity from occurring.

It is important to note that there were limitations in some of the studies that were discussed. In the "Screen Time" section of the article, the paper stated that under a quarter of children ages 6-17 receive an hour of physical activity daily. However, as the intensity of an exercise increases, the time spent exercising decreases. This may reduce the amount of time one spends exercising and may place them below the recommended daily amount of physical activity, even though they are still exercising. Additionally, in this day and age, many students have increased screen time due to schoolwork, which may have impacted the results in some of the studies mentioned. Another factor that wasn't considered was whether children were active in front of screens. For example, a child could have been watching a workout video or could have been attending a virtual dance class.

Conclusion:

To conclude, pediatric obesity is becoming a more and more common occurrence in the United States. The recent increase in child obesity rates is a sign that this matter must be addressed. There are a variety of reasons that have caused this, ranging from dietary factors to genetic components. Additionally, the article also discussed common health complications, both physical and psychological, that could arise if pediatric obesity isn't treated. Finally, the paper discussed some of the methods of intervention that have been put in place in the United States to help stop the rise of childhood obesity rates.

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