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NORTHERN ILLINOIS UNIVERSITY

Childhood Obesity Long-term Effects into Adulthood

A Capstone Submitted to the

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With Honors

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By

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Childhood Obesity Long-term Effects into Adulthood

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Childhood Obesity Long-term Effects into Adulthood

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Nurs 499: Senior Project in Nursing

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Dec 6th, 2020

Abstract

Childhood obesity has reached an epidemic level in the United States and is close to becoming a pandemic. Approximately eighteen percent of US children are obese; this is more than double the percentage from three decades ago. Obesity is commonly associated with other chronic health conditions which makes it not only a concern for adolescents but adults. Chronic conditions often seen in combination with obesity are hypertension, hyperlipidemia, diabetes, sleep apnea, poor self-esteem, and depression. In addition, studies done on adolescents to adulthood showed increase likelihood to suffer from cardiovascular disorders and digestive disease. The combination of childhood obesity and the chronic health conditions ultimately affects that child's adult health and can potentially affect their life expectancy. The purpose of this literature review is to determine how childhood obesity affects the overall health of an adult and their life expectancy. The literature reveals that an obese child is more prone to adult obesity, cardiovascular risk, premature mortality, and type two diabetes.

Childhood Obesity Long-term effects into Adulthood

Childhood obesity has become an epidemic in society. Child obesity prevalence is currently about eighteen percent (“Childhood Obesity,” 2020), which correlates to approximately 13.7 million children and adolescents being affected. With the growing rates of child obesity, the consequences of the disorder are bigger than ever. Childhood obesity not only affects the child’s health during their adolescent years but can progress into adulthood. Children that are obese are more likely to have health problems relating to their physical, psychological, and social health (“Childhood Obesity,” 2020). These health issues can further be identified as high blood pressure, high cholesterol, increased impaired glucose intolerance, insulin resistance, type two diabetes, breathing problems, musculoskeletal discomforts, and fatty liver disease (“Childhood Obesity,” 2020). These health concerns do not just disappear, especially if the obesity continues into adulthood because these disorders will become exacerbated. These exacerbated conditions can include worsening of the chronic conditions mentioned above, increased depressive symptoms due to lack of development of self-esteem, and ultimately premature death (“Childhood Obesity,” 2020).

Methodology

In order to answer my research question on the long-term effects of childhood obesity into adulthood, I conducted a literature review. I chose ten peer-reviewed articles from databases reached through Google Scholar searches and the Northern Illinois University Library databases such as CINAHL. I narrowed my research to articles within the last ten years except for two articles which were within the last twenty years when obesity started to rise. I used key words such as childhood obesity, diabetes, coronary artery disease, premature mortality and depression.

Results

One article that begins to dig into this issue is “Comparison of Health-related quality of life (HRQoL) among healthy, obese and chronically ill Iranian Children” (Farahani et al., 2018). This HRQoL is defined as the concept of physical, psychological, and social aspects of health from the individual's own perception of their health. This was a cross-sectional study done on 802 children between the ages of eight and twelve; ninety-eight of whom were classified as healthy, 102 as obese and 602 with other chronic diseases. They used a pediatric quality of life inventory as a data collection tool which was given to the children and their parents. The results of this study showed that in both girls and boys, those who were obese had the lowest total HRQoL scores and those that were of a healthy weight had the highest. The idea of healthy versus obese was determined by BMI Z-score and to be classified as obese the Z-score had to be over 2SD. However, the results went deeper than just obese children having lower total HRQoL. It was broken down further into subscales. These subscales measured physical functioning, emotional functioning, social functioning, and school functioning. Among the girls, the lowest subscales were among those with chronic diseases. Among the boys, those who were obese showed lowest social HRQoL and those with chronic conditions had lowest physical, social, and school functioning. The parents' scores aligned with the children's scores. The results of this study aligned with previous studies that reported poorer HRQoL scores in obese children and adolescents, according to the study itself. This study aided in the studies of obese children versus other children with chronic diseases as seen in the results above; those who were obese had the lower total HRQoL but when broken down into the subscales, those with chronic conditions had lower scores depending on the subscale. The fact that the study used both the child's point of view and their parents was

a strength because not all kids can speak for themselves. This study was also important to research because it showed how different health conditions affect different functioning in children.

Childhood obesity can result in premature mortality, specifically in middle age adulthood and onward (Lindberg et al., 2020). However, not much research has been conducted on the increase of mortality in early adulthood. An article that studies this concept is titled “Association of Childhood Obesity with Risk of Early All-Cause and Cause-Specific Mortality: A Swedish Prospective Cohort Study” (Lindberg et al., 2020). In this study, they looked at 41,539 individuals from childhood into young adulthood. Of the participants studied, only 7,049 were in the Swedish childhood obesity treatment registration classifying them as the obese population. The cause of death was pulled from the Cause of Death Register. Mortality was classified into two groups which were all-cause mortality and cause-specific mortality; cause-specific mortality was further broken down into endogenous causes, suicide/self-harm, and injuries. The results of this study showed that those with childhood obesity had a mortality rate of 12.0 per 10,000 compared to the comparison group who had a mortality rate of 4.1 per 10,000 in the all-cause mortality group. This showed that those with childhood obesity have three times greater risk for all-cause mortality compared to their counterparts. They found that those that had childhood obesity had an increased risk of death from suicide and endogenous causes than the comparison group. However, in both groups, suicide was the most common cause of death. Of the childhood obesity group, twenty-six percent had obesity as the primary or contributing factor to their death.

This study was unique from previous studies because it took place after the obesity epidemic began in the early 1990s; so it is more indicative of how childhood obesity affects individuals today. This study also aided research because it found that the severity of the obesity

influenced the risk for premature death. They found that individuals with the highest quartile of BMI when compared with the lowest quartile had a significantly greater risk for death from endogenous causes.

Another article that also studies the effect of childhood obesity and premature mortality is an article titled “Long-term Impact of Overweight and Obesity in Childhood and Adolescence on Morbidity and Premature Mortality in Adulthood Systematic Review” (Reilly & Kelly,2011). This study excluded any research conducted before 2002; this is a strength of this study because it contributes more to current research as it is indicative of present obesity rates and mortality rates. It also excluded any study that only had adult obesity as an outcome. However, this was also a limitation to the study because these cohort studies were still before the obesity epidemic outbreak. Another strength of this study is that it is a systematic review, so it did not focus on the results of one study but of multiple cohort studies varying in sample sizes. This study reviewed a total of eight articles related to mortality, eleven articles related to cardio-metabolic morbidity and nine other morbidity articles for a total of twenty-eight articles related to childhood obesity and mortality/morbidity.

Of the eight articles studied on childhood obesity and premature mortality, only one article did not find a significant increased risk for premature mortality. The one article that did not find the significance did not use exact BMI measurement but the perceived idea that the child was overweight. The eleven articles discussing childhood obesity and cardiometabolic morbidity all reported that childhood obesity was linked significantly with increased risk for diabetes, stroke, coronary artery disease, and hypertension later in life. Overall, the review highlights again that childhood obesity can be directly correlated with premature mortality or morbidity, as evidenced by several studies as evidence by hazard ratios ranging from 1.4 to 2.9 from the

articles reviewed. Within this review, the authors state that they believe their review can be useful in putting the emphasis on obesity prevention and treatment in adulthood since it proved the long-term effects of childhood obesity to be life-threatening, while many literature focuses on the short-term effects and impacts.

Another article that looks closely into childhood obesity and premature death is an article called “Childhood Obesity, Other Cardiovascular Risk Factors, and Premature Death” (Franks et al., 2010). This study was conducted on 4,857 adolescents in Arizona. The participants were born between the years of 1945 and 1984. These children were assessed on the extent to which Childhood BMI, 2-hour glucose level, blood pressure and total cholesterol affected premature death. The factors that were examined were from the baseline and continued until death, fifty-five years of age or the year of 2003; they fell under whichever parameter came first for that individual. The study resulted in 559 dying before fifty-five years of age with a total of 166 of the deaths being from an endogenous cause. They found that BMI was associated with the premature death from endogenous causes but not external causes. The rates from endogenous causes was more than doubled for children in the highest quartile of BMI compared to children in the lowest quartile. The 2-hour plasma glucose test was not associated with premature death from either endogenous or external causes. However, those in the highest quartile of glucose had a seventy-three percent higher risk for premature death, but when adjusted for childhood BMI the magnitude of association was reduced. This shows that though high glucose levels can cause premature death, the BMI still plays a large effect. There were no associations of death rates and childhood cholesterol levels or blood pressure.

Childhood obesity does not always cause premature mortality in adulthood, but it can be linked with other health conditions in adulthood like high cholesterol. “The Relationship

Between Childhood BMI and Adult Serum Cholesterol, LDL, and Ankle Brachial Index” is a study that focuses on the other health concerns childhood obesity can cause in adulthood (Sundaram et al., 2014). This study was conducted as a follow up to a previous study done in 1982. The original study performed a cardiovascular risk assessment on 3,106 school aged children. Out of the original sample, this study analyzed only 647 children now in adulthood, 153 of whom had childhood obesity as evidenced by a BMI greater than the eighty-fifth percentile in 1982 and 494 who were below the eighty-fifth percentile. They found that BMI z-score, serum LDL, 2008-2009 systolic and diastolic blood pressure and waist-to-hip circumference were slightly lower in the group with BMI less than the eighty-fifth percentile. This study concluded that childhood obesity was not significantly associated with adult CVD risk after controlling for adult weight status. This study, however, could not adjust for childhood BMI separately from adulthood BMI. This study is more indicative of the idea that adult BMI is more associated with CVD risk which was not the aim of this study. However, since this study found that childhood BMI is correlated with adult BMI, it was relevant to my research as an indirect correlation. Also, it does not discredit my hypothesis because it still shows some association, even though it may not be the direct cause.

The previous article did not show a significant correlation of childhood obesity and cardiovascular disease when adjusted for Adult BMI. The article “Childhood Obesity and Adult Cardiovascular Disease Risk Factors: A Systemic Review with Meta-analysis” shows that adult BMI may be a mediator, but there is a correlation between childhood obesity and CVD (Umer et al., 2017). This systematic review found that childhood obesity is significantly and positively associated with the CVD risk factors such as systolic blood pressure, diastolic blood pressure, and triglycerides. It also was inversely related with adult HDL. There were only twenty-three

articles included in the systemic review and twenty-one in the meta-analysis. The articles used in the study meet the requirements of being a longitudinal study, having child exposure with adult outcomes, having child obesity as the main variable, being written in English, using CVD as primary outcome, and having the measurements assessed by health professional. The study also found that when adjusting for adult BMI, the association was significant and negative for systolic blood pressure, diastolic blood pressure, and LDL. The association of HDL and triglycerides became non-significant when adjusted for adult BMI.

One other article that speaks to CVD risk and Childhood obesity is an article titled “Childhood Obesity and Cardiovascular Disease” (Bridger, 2009). This article is consistent with the two previous articles in the idea of CVD being more associated with adult BMI. However, it does highlight that the CVD risk could begin in childhood. In this study, they look at accelerated atherosclerosis which begins in childhood. According to the article, atherosclerosis is usually subclinical and has a slow progression in children. However, the same cardiovascular risk factors present in adults are seen to increase progression rapidly in childhood. Childhood obesity is one of those risk factors which causes early appearance of lesions. When tracking CVD consequences from childhood to adulthood, they found that obese children have the CVD risks of dyslipidemia, hypertension, insulin resistance, and metabolic syndrome. These CVD risks are also seen in adulthood and those that were obese as a child showed higher prevalence for those risks.

The previous article mentions insulin resistance and how it contributes to CVD risk in adulthood from individuals who were obese as a child. However, childhood obesity can directly increase insulin resistance and diabetes. The first article that address childhood obesity and insulin resistance is “Childhood Obesity Leads to Adult Type 2 Diabetes and Coronary Artery

Disease” (Fang et al., 2019). This study was unique in that the study was done by two-sample Mendelian randomization (MR). In the Inverse variance one (IV1) model, they found that childhood obesity was associated with a sixteen percent increased risk for type 2 diabetes. In the IV1 model, they also found a seven percent increased risk for coronary artery disease. In a different model referred to as the penalized robust IVW model, they obtained similar results for both type 2 diabetes and coronary artery disease increased risk. This study suggested that there was a genetic predisposition for children with obesity to have increased risk for type 2 diabetes and coronary artery disease in adult life. The study also showed increased risk for high BMI as an adult, waist circumference, hip circumference, waist-to-hip ratio, long-fasting insulin, homeostatic model assessment of insulin resistance and triglycerides. This study also suggested that childhood obesity causes decreased HDL in adult years.

The previous article talks about how childhood obesity causes type two diabetes in adulthood; however, the next article looks at how insulin resistance in childhood due to obesity effects adult obesity. They both correlate diabetes, child obesity, adult obesity and insulin resistance, but in different matters. “Insulin Resistance and the Persistence of Obesity from Childhood into Adulthood,” is a study conducted on two hundred and fifteen Caucasian children (Maffeis et al., 2002). Obese children were defined by being greater than the ninety-fifth percentile for BMI. The study found varying result in the women verse men comparing the baseline values and BMI in adulthood. For women they found that child BMI was the most important predictor for adult BMI. However, they also found that insulin resistance in women at the childhood ages, showed decrease obesity in adulthood. The values are as followed, for every increase in one unit of insulin resistance (Homeostasis model assessment) decreased the women risk for obesity as an adult by forty-two percent. For the men, child BMI was the only significant

predicator for adult BMI. There was no significant effect of insulin resistance and decrease obesity rates in adulthood. Of this population those who were obese at the childhood baseline about forty-three percent were still obese as adult, twenty-nine percent dropped to the overweight range and twenty-eight percent returned to normal weight according to BMI. In the women the severity of the obesity also influenced the likelihood of remaining obese. They accounted the persistence of obesity to be caused by the prolonged adverse effects of the cardiovascular risks such as unfavorable lipid profile, hypertension, increase circulating insulin levels, and altered glucose tolerance.

Childhood obesity does not only affect physical health in adulthood but also emotional health as well. An article that takes a deeper look into the emotional aspect of childhood obesity in later life in their study titled “The Long-arm of Adolescent Weight Status on Later Life Depressive Symptoms” (Martinson & Vasunilashorn, 2016). This study is strong in the fact that it had multiple follow up periods along the course of the study; however, they only focused on the most recent follow up in 2004. It also had a large original sample size of 10,000. This study is unique in that it did not use actual BMI measurements from weight. It used a standardized relative body mass index from high school yearbook photos. Thus, they used facial adiposity to determine BMI. The article found that childhood obesity and increase in depressive symptoms was not prevalent in men but was significantly prevalent in women. Overweight women are two times more likely to have depressive symptoms in later adulthood than normal weight counterparts. This study did account for social economic status and found that women with higher depressive symptoms came from the lower social economic classes. The study also found that women who were obese in high school and at the current age were three times more likely to experience depression compared to women of normal weight.

According to the article their results align with prior work in Australia, United States and Britain. In Australia they found the association in both men and women, until they adjusted for adult BMI and then it was just seen in women (Martinson & Vasunilashorn, 2016). The US study showed that women in the two highest categories of body shape at ages ten and twenty had higher prevalence and incidence of adult depression. This article suggests that the later-life depressive symptoms is due to the under development of self-esteem in early life. It mentions a Canadian study that found children who were obese at baseline had two times more odds of reporting low self-esteem four years later than their normal weight counterparts.

Discussion

Overall, the results show that childhood obesity is correlated with many poor health conditions in adulthood. The first and most prominent issue being premature death. Of the ten articles reviewed three articles focused on child obesity and its direct correlation to premature mortality; however, about only half addressed the risk and conditions that contribute to premature death. Majority of the premature deaths were due to endogenous causes. Those with childhood obesity were found to be two to three times more likely to have premature mortality. Premature mortality usually happened in middle adulthood; however, it was dependent on the severity of the obesity. Those who were in the highest quartile of BMI, had earlier mortality than those of the lowest quartile. This shows that though obesity is related to premature death it also has a lot to do with how bad the obesity is and the other health conditions the individual has.

The study on premature mortality also showed suicide as one of the primary reasons for death. This connects with the other issues associated with obesity. I am referring to the development of self-esteem and their personal opinions of health care related quality of life. Overall children who suffered from childhood obesity had low total health care related quality of

life, even when compared with children who had other chronic health conditions. In terms of later life depressive symptoms, women were more likely to have them in adulthood than men, which relates back to their development of self-esteem as a child. Though, I only found two articles addressing the emotional/psychological aspects child obesity has in adulthood, these articles mentioned previous research that also concluded similar results to their own. Which showed greater correlation. The emotional/psychological deterrents of childhood obesity are not as well studied as the cardiovascular and metabolic consequences, I concluded this by the lack of articles found dealing with these conditions verses the abundance of articles studying child obesity and the cardiovascular system.

The studies done on child obesity and cardiovascular issues, are contradicting to my prediction that cardiovascular risk in adulthood can be contributed to child obesity. The articles reviewed, all testified to the idea that adult BMI is more associated with cardiovascular risk. However, the cardiovascular risk seen in adult obesity are also seen in child obesity and can start to develop in childhood. One of these risks being atherosclerosis which is accelerated by obesity. Other cardiovascular risk seen in child obesity are increased systolic blood pressure, diastolic blood pressure, waist circumference, hip circumference, waist/hip ratio, and triglycerides. There were also inverse relations with HDL according to two of the articles. Therefore, child obesity is more associated with child CVD risk than adult CVD risk; correction on BMI in adulthood can decrease the CVD risk.

Insulin resistance and type two diabetes have an interesting correlation with obesity levels in childhood and adult hood. It is evident that obesity can contribute and cause type two diabetes, but according to the literature reviewed, the early insulin resistance in childhood can decrease adult obesity levels. However, this association with decreased levels of obesity in adulthood was

only apparent for women. There was no correlation seen in men. However, when it comes to the development of type two diabetes from childhood obesity it is seen in both men and women. However, the article discussed shows that it is also related to a genetic predisposition; which was new to research according to the article and not enough research to prove that it is more related to genetics than the obesity.

There were a few limitations to my research and within the articles reviewed. The limitation being the lack of articles related to some of the other issue's obesity can cause. For example, there were many articles on the cardiovascular risk, but very few on the emotional aspects. Many of the articles had small population sizes, or a decrease in sample sizes in their follow up periods.

Conclusion

In conclusion, it is apparent that childhood obesity, has many effects on the physical and emotional health of their adult self's. These effects include adult obesity, premature mortality, increase risk for type 2 diabetes, and depression or decreased quality of life. Childhood obesity is also, seen to cause increased CVD risk; however, there is still not enough literature and studies conducted to confirm the direct correlation. CVD risk are more associated with the adult BMI levels. Given that childhood obesity can lead to adult obesity, they are indirectly related, also being that the same CVD risk are seen in both child obesity and adult obesity. Given that children that are obese are two times more likely to die prematurely, shows that childhood obesity does have long-term consequences. The consequences are also severe and detrimental to adult health. Therefore, early prevention and treatment is need for child obesity, because the higher the BMI quartile the more at risk the individual is at in childhood and adulthood. Therefore, prevention and treatment of childhood obesity needs to be focused on

heavily. The rates are spiraling out of control decreasing life and quality of life in many individuals. Getting control over childhood obesity can help decrease other health conditions that are exacerbated by the obesity.

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