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# Early Antibiotic Exposure and Childhood Obesity

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## Abstract

Obesity is becoming a growing concern in today's population. Over the last thirty years, obesity rates have doubled in adults and quadrupled in adolescents. One of the more recent theories is that childhood obesity is influenced by early exposure to antibiotics. The purpose of this project is to discuss how antibiotics alter the human gut microbiota and how this affects nutrient consumption, which can lead to childhood obesity. There is a focus on the current research studies that address if, indeed, there is a link between childhood obesity and early antibiotic exposure. Through a review of several electronic databases and several peer reviewed research articles, my research has found that there is a link between early life antibiotic exposure and childhood obesity. Studies have shown that the younger the child is at the time of antibiotic exposure, the higher the risk of obesity. In addition, the more frequent the antibiotic exposure the higher the risk, and overall, males have a higher risk than females. These findings could have an impact on future clinical practice and probiotic use.

## Research Question

Is antibiotic exposure in early childhood associated with an increased risk of obesity in later childhood and adolescence? Does the timing, frequency of antibiotic exposure, the pharmaceutical class of antibiotic, or the individual's gender make a difference in weight gain?

## Discussion

- ❖ Two studies have shown increased risk of obesity in children whose mothers were exposed to antibiotics during pregnancy.
- ❖ One study showed an increased risk in obesity if the exposed mother is of normal weight but showed a decrease in obesity if the exposed mother was obese. One study did not show any relationship to obesity and exposure to antibiotics in utero but did show an increase if child is exposed in the first year.
- ❖ Eight studies have shown that there is an increase in childhood obesity when children are exposed to antibiotics in the first year of life. More often than not the studies showed this was especially true in males and with repeated antibiotic exposure.

## Applicability to Clinical Practice

Current research shows that the gut microbiota is very important in the maintenance of health and weight. The research has also shown that antibiotics affect the gut microbiota and probiotics help to maintain it. If we are able to gain enough research into which types of probiotics give the most benefit and for what populations we could have improved outcomes in the future.

Clinical trials of a medication called Vivomixx are in their beginning phases. This medication is a combination of *Streptococcus thermophiles*, *bifidobacteria*, and *lactobacilli*. This medication will be given to pregnant women starting between 14 and 20 weeks and continuing until delivery. Researchers hope to find that it can control weight gain, reduce pregnancy complications, and alter infant's gut microbiota therefore promoting development and health (Halkjaer et al., 2016). This new treatment modality could be very beneficial in clinical practice for attacking the obesity epidemic.

## Introduction

- ❖ Obesity rates have grown exponentially in the last few decades. In the United States obesity affects 12.5 million children.
- ❖ Obesity increases the risk of hypertension, hyperlipidemia, diabetes, and sleep apnea.
- ❖ On average in 2006 an obese person spent 42% more on health care than a normal weight person.
- ❖ Overuse of antibiotics leading to alterations in gut microbiota has become one theory behind childhood obesity.
- ❖ In 2011 there were over 1,000 prescriptions for antibiotics per 1,000 individuals ages birth to nine and ages older than sixty-five. This means these groups are getting more than one antibiotic course per year

## Literature Review

### Background of the Human Gut Microbiota

The gut microbiota functions to help extract energy from foods, protect against colonization with harmful pathogens and microorganisms, and regulate proliferation and differentiation of epithelial cells. (Villanueva-Millian et al., 2015) Alterations in any of these can lead to dysbiosis. "Dysbiosis is an abnormal colonization or imbalance of microbes inhabiting a certain part of the body" (Houghteling & Walker, 2015). Antibiotics alter the gut microbiota and increase the risk of obesity due to lasting effects on the immunity and metabolism capabilities of the gut. (Houghteling & Walker, 2015)

### Potential Treatment Modalities

Probiotics have been used to maintain gut microbiota and are currently being suggested as a potential treatment for obesity. At this time there has been limited research on this topic especially in regard to children. However, a series of studies by Kadooka et al. (2010) has shown that consumption of *Lactobacillus gasseri* (LB2055) at concentrations of 10<sup>6</sup> cfu have shown reduction in visceral fat, BMI, and hip and waist circumference. This study does show that continuous supplementation is needed to preserve this effect.

### Early exposure to Antibiotics and Childhood Obesity

Author	Sample	Findings	Downfalls
Muller et al., 2015	436 women/children pairs	84% increased risk of obesity when exposed to antibiotics in the second or third trimester	Population was narrowed to African American and Dominican Women. Could not generalize to entire population
Ajslev et al., 2011	28,354 women/children pairs	Antibiotics given to normal weight mothers increased risk of children being overweight (OR 1.54, 95% CI: 1.09-2.17). Antibiotics given to obese mothers children had a decreased risk of becoming overweight (OR: 1.05, 95% CI: 0.58-1.89)	Height and weight were self-reported
Trasande et al., 2012	11,532 children	Children of normal weight exposed to antibiotics at less than six months of age had a 29.4% increase in being overweight at 38 months.	
Saari et al., 2015	6,114 boys and 5,948 girls	In males any exposure and the younger the child at time of exposure the greater the impact on increased BMI. Largest difference was when boys were exposed to macrolides two or more times.	
Bailey et al., 2014	64,580 children	Four or more broad spectrum courses of antibiotics increased obesity risk p=0.02	
Scott et al., 2016	21,714 children	Children exposed to antibiotics in the first two years of life especially repeating doses of antibiotics there was a 25% relative increase for risk of childhood obesity.	
Murphy et al., 2014	74,946 children	Increased risk of obesity with early antibiotic exposure in boys p<0.0007 but was not statistically significant in girls p=0.34	

## Statement of the Problem

With the recent increase in adult and childhood obesity and the often inappropriate prescribing practices of antibiotics, we need to establish (1) Is there a causal link between antibiotic exposure and childhood obesity, and (2) What potential treatment modalities exist to prevent disturbances of gut microbiota when antibiotic treatment is necessary?

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