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**Introduction of Solid Foods Prior to Six Month of Age and Childhood Obesity**

By

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Capstone Project

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## **Abstract**

Introduction of solid foods is an important milestone for infants that marks a when solid foods are added to breast milk or formula. This transition is usually discussed with parents at their scheduled Well Child Visits by the pediatrician. The age at which solid foods are introduced into the diet may have potential effects on the child's health throughout their life. This review focuses on the timing of introduction of solid foods prior to six months of age and the association of the child developing childhood obesity. The association between the timing and an infant's risk of developing childhood obesity is unclear. The evidence in currently available studies does not confirm the association between childhood obesity and the introduction of solid foods before six months of age.

## **Introduction**

The importance of the introduction of solid food in children has been analyzed repeatedly; guidelines have changed multiple times over the past 10 years. The purpose of this paper is to examine the medical literature to determine whether introduction of solid foods before the age of six months compared to starting after this age increases an infant's risk for developing childhood obesity [BMI of 85% or greater for age group] at age six years old. The most recent estimates from the World Health Organization and the International Obesity Task Force of the International Association for the Study of Obesity are that more than 155 million children and adolescents around the world are overweight, and approximately 40 million are clearly obese.<sup>1</sup> Health consequences of obesity have been well documented in adults and include higher incidences of illnesses such as respiratory difficulties, musculoskeletal disorders, cardiovascular diseases, and conditions related to insulin resistant diabetes. Thus the importance of preventing early-onset obesity is of particular importance to society and the medical community because

early diagnosis and intervention allow providers to initiate preferable treatment such as lifestyle modifications and exercise as opposed to long-term pharmaceutical care. Identifying any correlation between the introduction of solid foods and the risk of childhood obesity in the first six months of life and the risk of childhood obesity can be one the first and most important steps a provider can take. Providing parents education may prevent their child being diagnosed with childhood obesity early in life. Previous studies have not shown a correlation between childhood obesity and the timing of solid food introduction.

### **Discussion**

PubMed and Google Scholar were researched for relevant articles. Search criteria included meta-analyses, randomized control trials, clinical trial, research articles, and systematic reviews published within the last 10 years. PubMed searches using the keywords “childhood obesity and introduction of solid foods,” childhood obesity in children under age six,” Timing of introduction to solid foods in infants,” and “childhood obesity,” aided in locating articles relating to the topic of interest.

One study followed a group of infants until the age of six years old, found the prevalence of obesity was 12.0%, and concluded that the odds of obesity were higher among infants introduced to solids less than four months compared to those introduced at four to six months. Introduction of solids later than six months was not associated with obesity.<sup>2</sup> Initial studies of the introduction of solid foods in infancy also took into account the status of breast vs. formula fed infants and the correlation of solid food introduction. The study included 1181 infants who participated in the Infant Feeding Practices Study II (IFPS II) and the Year Six Follow Up (Y6FU) study. This study concluded that the timing of introduction of solid foods was not

associated with childhood obesity at six years of age and noted that further studies in larger populations may be needed.

In an observational Danish study, mothers filled out a self-administered questionnaire approximately six months after their infant's birth. Questions were focused on the timing of solid food introduction. The study consisted of 4503 infants. Variables that could have influenced the studies results included breastfeeding time intervals, duration of formula feeding, and timing of introduction of solid foods. Breastfeeding was the single most important indicator for preventing early introduction to solid food. Modifiable predictors pointed to the importance of supporting breastfeeding and educating primipara and mothers with low birth weight infants to be able to read and respond to their infants' cues to prevent early introduction to solid food. The findings in the study were consistent with the data that indicated early introduction of complementary food tends to interfere with breastfeeding and increase growth, leading to an increased risk of developing child obesity.<sup>3</sup> The choice to start feeding solid foods relied heavily on mothers who breastfed rather than mothers who had formula fed their infants. Mothers that stopped breastfeeding prior to six months of age began introducing solid foods in place of breast milk. These children had a higher incidence of childhood obesity compared to mothers that continued to breast feed through six months of age. The main weakness with this study is the confounding factors, which made it difficult to find the correlation between introduction of solid foods and the correlation to childhood obesity.

In a meta-analysis published by The American Academy of Pediatrics in 2015,<sup>4</sup> researchers suggested that introduction of solid is a multifactorial decision which includes consideration of parameters such as infant motor skills and drive for feeding, gluten and food allergies, celiac disease, metabolic syndrome, and the role of breast-feeding. "Metabolic

Syndrome” (MS) refers to a clinical condition in which there is an increased risk of cardiovascular disease due to the presence of multiple factors, including visceral obesity, dyslipidemia, a state of insulin resistance and arterial hypertension. Some observational studies suggested that an early introduction of solid foods might increase the risk of obesity, with a lower risk for breast-fed as opposed to formula-fed infants. There was no evidence that the age of introduction of complementary foods had an effect on the risk of developing obesity, type two diabetes, coronary disease, and hypertension.<sup>5</sup> One of the more important conclusions drawn from this study was the introduction of complementary foods into an infant’s diet was based off the interest in food by the infant and the competencies to feed. The beginning of the introduction of solid foods at 6 months of age remains a desirable goal also in Western societies, although it would be advisable to introduce solid foods together along with breast milk before six months of age. It has been suggested that complementary foods should not be introduced before four months of age.<sup>6</sup> However if an infant has a strong desire and expresses interest in solid foods then there are no negative consequences from introducing certain foods to the infant prior to the age of six months.

### **Limitations**

These studies were limited for several reasons. There were few definitive studies to derive conclusive results regarding the timing of solid food introduction and childhood obesity. A lack of follow up on the mothers involved in the studies, the follow up in studies performed outside the country. Many of the studies relied heavily on volunteer questionnaires that may not have been the most reliable means of collecting information or were not optimal for participation in the follow-up questionnaires. Another limitation was that different researchers who examined the same topic often used data from the same population samples but may not have included or

excluded information, a process known as “cherry picking”. Therefore, this review did not arrive at an answer to the question of whether early introduction of solid food is associated with childhood obesity. Further research is needed to address this question specifically.

### **Summary of Findings**

Key findings from these studies show that whether an infant is breast-fed or formula-fed correlates more with the risk of developing childhood obesity than does the introduction of solid foods prior to 6 months of age. A longitudinal study in Australia concluded that the odds of overweight or obesity were significantly higher among infants introduced to formula or solids at  $\leq 4$  months compared to those introduced at  $> 4$  months. This study was conducted from children aged zero to one year at baseline until they reached age 10 or 11 years and was defined by body mass  $> 85^{\text{th}}$  percentile.<sup>8</sup> Specifically, breast-fed infants are less likely to develop childhood obesity. There have been multiple studies emphasizing the importance of breastfeeding and the positive outcomes related to breastfeeding for a minimum duration of four months. The benefits reported are related to infant growth, and decrease in development of atopic dermatitis and allergies earlier in the infant’s life.

An additional finding shows that health provider’s educational efforts and early interventions with parents play a major role in the introduction of solid foods for infants in the early months of life. Proper education given to parents at prenatal appointments, well child checks, and resources given to parents prior to delivery of the newborn can drastically reduce the introduction of processed foods. Poor diet choices are associated with lower maternal economic status, education, and age. Thus health care providers can play a critical role in patient education thus increasing awareness of the potential complications of childhood obesity encountered earlier in life when low nutritional solid foods are introduced early to infants.

## Conclusion

Introduction of solid foods prior to the age of four months is no longer supported by the American Academy of Pediatrics. Introduction of solid foods at 6 months of age is still a topic being debated by many of the professional organizations today that outline the standard of care for pediatrics. Until additional research with larger study cohorts, follow up for longer terms, and increased participation from participants is achieved, a risk analysis cannot be performed. Since the introduction of solid foods prior to the age of six months has not been effectively proven to increase the chances of childhood obesity, advising parents to avoid giving solid foods before that age can only be given as a recommendation and not as an established guideline.<sup>7</sup> The American Academy of Pediatrics has not changed current guidelines because evidence on solid food introduction and the risk of childhood obesity is inconclusive. Continuing to collect data on the timing of introduction of solid foods to an infants diet will provide insight to the correlation of childhood obesity.

Childhood obesity is a growing epidemic in the United States and worldwide which increases the likelihood of adolescents being diagnosed with respiratory diseases, cardiovascular diseases, non-insulin dependent diabetes, and infertility. Obesity prevalence among infants and young children has increased rapidly during the past four decades. This issue needs to be addressed due to early obesity's association with later life obesity and its comorbidities. Infancy is a period of behavioral patterns and engraining healthy eating and feeding habits offering numerous targets for preventive interventions. Modifiable factors that may affect early rapid weight gain and obesity risk include infant sleep duration, feeding to soothe infant distress, and the introduction of solid foods and transitional feeding.<sup>9</sup>



Health care providers play a crucial role in educating patients and parents and implementing treatment plans earlier in life that include lifestyle modification, diet recommendations, and exercise routines to decrease the chances that children and adolescents become reliant upon pharmaceutical medications for the duration of their life. Whether the timing of solid food introduction determines childhood obesity risk needs to be researched and studied further so that scientifically based guidelines can be established by which health care practitioners can base their recommendations.

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