

Introduction

- The ketogenic diet is a high fat, low carbohydrate diet that is an effective treatment for reducing seizures in infants and children with drug resistant epilepsy.
- Children with refractory epilepsy are at risk for malnutrition due to antiepileptic drug-nutrient interactions, developmental delays, and feeding problems.
- The ketogenic diet has also been associated with potential for decreases in weight and height percentiles and z-scores.
- Children on the diet are maintained in a level of ketosis in order for the diet to work as an epileptic treatment.

Aim: This study was conducted to assess growth related to caloric intake and to examine the relationship between ketosis / acidosis levels on growth outcomes.

Hypothesis: It was anticipated that higher bicarbonate levels will be associated with improved growth outcomes despite underlying medical conditions. On the contrary, higher ketosis levels will impair growth of patients.

Methodology

- Retrospective and prospective chart review conducted of all patients receiving the ketogenic therapy in the Comprehensive Epilepsy Center at Children's Mercy Hospital between 2007 and the present.
- Age, gender, height, weight, BMI, MUAC, caloric intake, laboratory values (serum beta-hydroxybutyrate and serum bicarbonate), and DEXA scan results were collected from subjects at visits.
- Diet was initiated at a 3:1 ratio during an inpatient admission. Energy needs were met for actual weight; if patient was underweight at baseline needs were met for ideal body weight. 100% of protein and micronutrient needs were met for all patients.

Results

Table 1

Patient Demographics (n = 177)	
Sex	Males = 89; Females = 88
Age of Seizure Onset	1.4 years ± 2.0
Age of Diet Onset	4.7 years ± 4.1
Feeding Route	By mouth = 98; Feeding tube = 79
Average Diet Ratio	3:1

Table 2

Relationship Between Serum Bicarbonate and Beta-Hydroxybutyrate Levels and Anthropometrics			
	Weight Percentile	Height Percentile	BMI Percentile
Serum bicarbonate	+	None	None
Serum beta-hydroxybutyrate	-	None	-

- Table 2 demonstrates:
 1. Higher serum bicarbonate levels are associated with higher weight percentile.
 2. Higher serum beta-hydroxybutyrate levels are associated with lower weight percentile.
 3. Higher serum beta-hydroxybutyrate levels are associated with lower BMI percentile.
 4. No positive correlation established between serum bicarbonate or beta-hydroxybutyrate levels and height percentile.

Table 3

Relationship of Serum Bicarbonate Levels (mEQ/L) with Weight Percentile		
	T Value	P Value
Weight Percentile	-3.18	0.0015
BMI Percentile	1.18	0.2368

Results Contd.

Table 4

Relationship of Serum Beta-Hydroxybutyrate Levels (mEQ/L) with Weight and BMI Percentiles		
	T Value	P Value
Weight Percentile	2.48	0.0133
BMI Percentile	-2.39	0.0174

Conclusions / Future Directions

- Previous research has shown high ketosis associated with a significant decrease in height-for-age z-scores.
- This research is consistent with previous research showing high ketosis is associated with a decrease in weight z-scores.
- Study highlights the importance of close monitoring children on the ketogenic diet for height, weight, and BMI changes.
- Higher ketone levels can be associated with decreased appetite which may explain the decrease in weight and BMI percentile (but was not studied in this dataset).
- Future studies including a larger group and randomized control environment can study longitudinal changes in ketosis and changes in height, weight, and BMI percentiles.

References / Credits

1. Neal EG, Chaffe H, Schwartz RH, et al. The ketogenic diet for the treatment of childhood epilepsy: a randomized controlled trial. *The Lancet Neurology*. 2008;7(6): 500-506.
 2. Levy RG, Cooper PN, Giri P. Ketogenic diet and other dietary treatments for epilepsy. *The Cochrane database of systematic reviews*. Mar 14 2012(3): CD001903.
 3. Liu Y-MC, Williams S, Basualdo-Hammond C, Stephens D, Curtis R. A prospective study: Growth and nutritional status of children treated with the ketogenic diet. *Journal of the American Dietetic Association*. 2003; 103(6):6.
 4. Peterson SJ, Tangney CC, Pimentel-Zablah EM, et al. Changes in growth and seizure reduction in children on the ketogenic diet as a treatment for intractable epilepsy. *J Am Diet Assoc* 2005;105:718-725.
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- This study was approved by the Institutional Review Board at Children's Mercy Hospital.