

# Energy Intake in Chronically Ill Children

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## Background

Chronically ill children vary in their rate of metabolism based on their diagnosis, respiratory status, and ability to ambulate. When a child receives a tracheostomy and requires mechanical ventilation, their energy expenditure decreases due to a decrease in the work of breathing. Other children may have a decrease in their energy needs secondary to their diagnosis. An observation by the Pediatric Home Service (PHS) dietitians was made suggesting a discrepancy in caloric requirement for their children relative to Recommended Daily Allowance (RDA) recommendations. The chronically ill children appeared to require fewer calories than their age appropriate peers. In addition, the dietitians were seeing that when their patients were admitted to the hospital, their nutrition regimens were changed leading to increased caloric intake which led to significant weight gain and often increased respiratory needs and other medical sequelae.



## Methods

A retrospective chart review was completed on the patient charts for 54 children for a total of 237 nutrition assessments conducted by PHS dietitians. The patients ranged in age from 10 months to 24 years of age; 35 of the patients were female (65%) and 19 were male (35%). In this study, 44% of the patients were 3 years of age or younger, 15% were 4 to 6 years of age, 35% were 7 to 10 years of age and 6% were older than 10 years of age. The data collected was taken from nutrition assessments completed on the patient when they were 0 to 10 years of age. All of the patients received nutrition support via a feeding tube and 46% of them had a tracheostomy and received respiratory support. Thirteen of the patients for whom data was collected had expired by the time data was collected. The Recommended Daily Allowance (RDA) for calories and protein was used as the comparison for each patient based on their age at the time of each nutrition assessment. The patients' primary diagnosis at the time of admission to PHS is outlined in Table 1. Most of the diagnoses can be associated with lower metabolic needs.

Table 1: Diagnosis of Patients

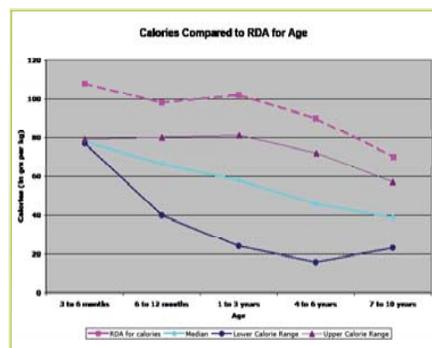
46 xx, q 1 deletion	IUGR
Agenesis of Corpus Callosum	Klippel Fiel Syndrome
Anencephalic Anoxic at Birth	Microcephaly
Brain Anomaly	Mobius Syndrome
Cardiomyopathy	Muscle Disorder
CHARGE Syndrome	Myasthenic Hypotonia
Congenital Heart Condition	Near Drowning
Congenital Muscular Dystrophy	Pierre Robin Syndrome
Congenital Quadriplegia	Pompei Disease
Cornelia De Lange Syndrome	Prematurity
Cri Du Chat Syndrome	Shone's Complex
Down Syndrome	SMA Type I
Encephalopathy	Spinal Anomalies
Epidermal Nevus Syndrome	Spina Bifida
Edwards Syndrome	Tetraology of Fallot
Gastrochisis	Tracheomalacia
Herpetic Encephalopathy	Traumatic Brain Injury
Intractable Epilepsy	Wolf Hirshorn Syndrome

## Results

Evaluation of energy intakes revealed that children ages 3 to 6 months required only 72% of the RDA; 6 to 12 months of age required 68% of the RDA; 1 to 3 years of age required 57% of the RDA; 4 to 6 years of age required 51% of the RDA; and 7 to 10 years of age required 55% of the RDA. The energy requirements decreased by 4 to 11% from 3 months of age to 6 years of age and then increased slightly when the children reached 7 to 10 years of age. Graph 1 provides a visual of the range in calories per kilogram and the median of the data.

Graph 1: Calories Compared to RDA for Age

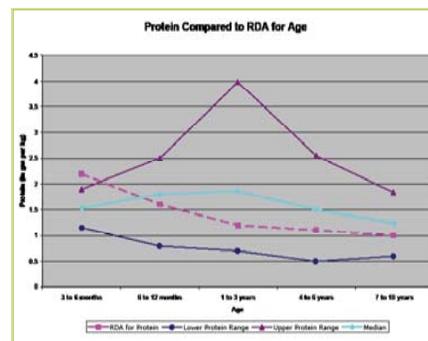
• Calories measured in kilocalories (kcal) per kilogram (kg) •



Evaluation of protein intakes revealed that children, age 3 to 6 months received 70% of the RDA, 6 to 12 months of age received 113% of the RDA, 1 to 3 years of age received 155% of the RDA, 4 to 6 years of age received 136% of the RDA and 7 to 10 years of age received 124% of the RDA for age. The protein intake increased by 43% from the 3 to 6 month old group to the 6 to 12 month old group and then increased by 42% when advancing to the 1 to 3 year old group, which was the highest percentage of the RDA for protein received amongst all groups. Graph 2 provides a visual of the range in protein in grams per kilogram and the median of the data.

Graph 2: Protein Compared to RDA for Age

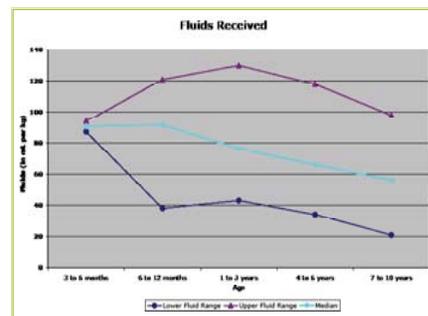
• Protein measured in grams (gm) per kilogram (kg) •



Fluids were evaluated to review the needs with respect to the calories and protein provided for the patients to maintain adequate growth. Graph 3 shows the data in milliliters per kilogram.

Graph 3: Fluids Received

• Fluids measured in milliliters (mL) per kilogram (kg) •



## Conclusion

The lowest percentage of caloric intake appeared to be in the 4 to 6 year old group, closely followed by the 7 to 10 year olds and the 1 to 3 year olds. The difference in part may be due to the progression of their disease process or syndrome and the effects it has over time on their body.

Protein intakes for the 3 to 6 month age group was only 70% of the RDA while other groups had an average intake higher than the RDA. Seventeen of the patients had diagnoses with cardiac, neuromuscular or respiratory involvement and this may have led to the increased need for protein.

All 54 patients received a nutritional supplement of some kind to provide multivitamins, iron, calcium, phosphorous, and/or Vitamin D when their decreased energy needs led to intake less than the RDA for calories. Further studies are needed to review the vitamin and mineral needs of chronically ill children and if they need the RDA for vitamins and minerals when they are not receiving the RDA for calories.

Involvement of a registered dietitian in the nutrition care of chronically ill children is necessary to provide adequate nutrition to promote appropriate, not excessive weight gain. The comparison of energy intakes show that medical professionals working with children with chronic illness should be aware of the differences in caloric need compared to the RDA. This knowledge can help medical professionals alter nutrition intake and provide for appropriate not excessive weight gain and growth.