

Energy intake in children

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GUIDELINES

No recommendations possible based on Level I or II evidence

SUGGESTIONS FOR CLINICAL CARE

(Suggestions are based on Level III and IV sources)

- **Children with chronic kidney disease (CKD) or end-stage kidney disease (ESKD) should have an energy intake (orally) equivalent to the recommended energy intake (REI) of healthy children (50th percentile for height) of the same chronological age to allow for catch-up growth. An alternative is to calculate energy intake for the child's height age and to provide additional energy to allow for catch-up growth.**
- **If this energy intake cannot be maintained consistently with oral feeding, the child should receive nasogastric or gastrostomy feeds.**
- **Resting energy expenditure (REE) appears to be similar in children with CKD to that of healthy children. Measurement of REE using indirect calorimetry in 7 children with CKD and GFR < 30 mL/min/1.73 m² indicates that mean REE was 98.1% of that predicted (Reed, unpublished data). REE have not been measured in children with ESKD.**
- **Increasing energy intake to 100% of REI in CKD and ESKD, using nasogastric or gastrostomy feeds if necessary, can improve or stabilise growth rates, particularly in infants treated before 2 years of age and before dialysis (Arnold et al 1983, Abitbol et al 1993, Brewer 1990, Ledermann et al 1999, Reed et al 1998, Van Dyck et al 1999). However, data from the North American Pediatric Renal Transplant Cooperative study (Ellis et al 2001) found no difference in weight and height standard deviation score (SDS) between children who did and those who did not receive supplemental feeds when aged < 5 years on dialysis. No data on achieved REI were reported.**
- **Increasing energy intake by intradialytic parenteral nutrition administered for 5 months results in reversal of weight loss and weight gain and improved body mass index (BMI) (Goldstein et al 2002).**
- **Increasing energy intake has been associated with a 55% decline in days of hospitalisation and a reduction in peritonitis from 1 episode per 8 patient-months to 1 episode per 23 patient-months compared with rates before nutritional supplementation was commenced (Dabbagh et al 1991).**

- **Peritonitis rates in dialysis patients does not increase following gastrostomy tube insertion (Ramage et al 1999).**
- **Net glucose absorption from peritoneal dialysis fluid contributes 7%–8% of total energy intake (Salusky et al 1983). This additional energy intake should be considered in the calculation of total energy intake in children who become overweight (BMI > 85th percentile of height age) on peritoneal dialysis.**

Background

Children with CKD or ESKD frequently have reduced linear growth and poor nutrition.

In relation to chronological age, children with CKD or ESKD ingest on average, less than 100% of the REI spontaneously. Energy intake averaged 10%–20% below REI in studies of children with GFR 15–75 mL/min/1.73 m² (Ratsch et al 1992, Foreman et al 1996). In children on peritoneal dialysis or haemodialysis, energy intake averaged 20%–27% below REI (Salusky et al 1983, Arnold et al 1983).

Studies indicate that increasing energy intakes to 100% REI may stabilise or improve linear growth (Arnold et al 1983, Abitbol et al 1993, Brewer 1990, Ledermann et al 1999, Reed et al 1998, Van Dyck et al 1999).

The objectives of this guideline are to review the available evidence for the benefits and adverse effects of REIs in children with CKD or ESKD.

Search strategy

Databases searched: Medline (1996 to November Week 2 2003) and Embase (1980 to November 2003). MeSH terms for kidney disease were combined with MeSH terms and text words for energy intake. The Cochrane Renal Group Specialised Register of randomised controlled trials was also searched for relevant trials not indexed in Medline.

Date of searches: 1 December 2003.

What is the evidence?

No randomised controlled trials comparing different energy intakes in children with CKD or ESKD or comparing different ways of feeding children to maintain energy intakes were identified.

Summary of the evidence

No guidelines based on Level I or II evidence can be formulated.

What do the other guidelines say?

Kidney Disease Outcomes Quality Initiative: The initial prescribed energy intake for children on haemodialysis or peritoneal dialysis should be the recommended dietary allowance (RDA) level for chronological age. Modification should then be made depending upon the child's response (Evidence and Opinion). No recommendations have been given for children with CRF.

British Renal Association: Children should receive enteral feeding (nasogastric, jejunal or via gastrostomy) to achieve adequate calorie intake if necessary.

Canadian Society of Nephrology: No recommendations for children.

European Best Practice Guidelines: No recommendations for children.

Implementation and audit

Data on height, weight and head circumference in relation to energy, protein and sodium intake and the number of children who require nutritional supplementation by enteral feeding could be collected and analysed by paediatric renal dietitians.

Suggestions for future research

Further studies are required to determine the REE in children with CKD and in children on dialysis.

References

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Appendices

Table 1 Nutritional supplements for use in infants and children with CKD

Product Name (Manufacturer)	Energy (kcal/mL)	Na (mmol/L)	K (mmol/L)	P (mg/L)	Protein (g/L)	Osmolarity (mosm/kg)
Standard infant formula	0.65	7	14	280	15	280
Kindergen (SHS)	1	20	6	186	15	249
Suplena (Abbott)	2	34.1	28.5	728	30	259.6
Nepro (Abbott)	2	36	27	686	70	635
Resource Fruit Beverage (Novartis)	1	10	2	675	37	700
Enlive (Abbott)	1.25	12	4	92	40	835
Renilon 4.0 (Nutricia)	2	14	26	40	40	5
Renilon 7.0 (Nutricia)	2	4	3	60	75	10
Polyjoule/Polycose	3.7	56	5	0	0	
Calogen (SHS)	4.5	90	50	0	0	NA

Table 2 Infant formulae for oral/enteral feeding of infants and children with CKD

Product Name	Feed Type	Age	Properties	Suggested Use
Kindergen (SHS)	Nutritionally complete	0–5 years	High energy, moderate protein, high Na, low K, low PO	Chronic Renal Insufficiency (CRI), acute renal failure, high serum K, polyuria & Na wasting. May require extra energy & Na or bicarbonate supplementation.
Standard infant formula	Nutritionally complete until 6 mths of age		Moderate protein, low PO	

Table 3 Enteral feeds for nasogastric/gastrostomy feeding of infants and children with CKD

Product Name	Feed Type	Age	Properties	Indications for Use
Suplena	Enteral	> 2 years (on dietetic advice)	High energy, moderate protein, moderate PO, low vitamin A	CRI, failure-to-thrive, dialysis
Nepro	Enteral	> 5 years	High energy, high protein, moderate PO	Peritoneal dialysis

Table 4 Nutrition and energy supplements to oral/ enteral feeds for use in infants and children with CKD

Product Name	Feed Type	Age	Properties	Indications for Use
Resource Fruit Beverage	Nutrition Supplement	> 5 years	High energy, high protein low K, low Na	CRI/ dialysis
Enlive Fruit Beverage				
Polyjoule/ Polycose	Energy Supplement	All	Glucose polymer	When extra energy intake required: add to oral/enteral/ infant formulae
Calogen		All	Liquid fat supplement (LCT)	

Table 5 Vitamin supplements for use in infants and children with CKD

Product	Dosage	Availability	Nutrient Composition	Indications for Use
Vitamin B Group Forte tablets	As per manufacturer's instructions for age	Chemist	B vitamins, Vitamin C, Folic acid	Dialysis, poor intake in CRI
Paediatric Renal Seravit (SHS)	As per manufacturer's instructions for age	Special Authority Script	Multivitamin, mineral & trace elements, no K, PO or Ca	CRI