

University Hospital Southampton NHS Foundation Trust  UNIVERSITY OF Southampton

## Energy and Micronutrient needs in Children with Chronic Kidney Disease and Dialysis

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### The child with kidney disease

<b>Problem</b>		<b>Challenges</b>
Complex		Different endotypes
Poor nutritional state: Malnutrition Obesity		Complexity
Disease: Inflammation Metabolic alterations		Differentiating needs
Therapy: Dialysis & Transplantation		Gaps in information

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### Why is nutrition & growth important?

- Morbidity and mortality
- Psychological issues
- Decrease in school attendance
- Increase in hospitalization
- Obesity rise and associated co- morbidities
- Multifactorial causes
- Effects of treatment
- Whole nutritional profile – gaps in knowledge

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### Why does this matter: Prevalence in CKD

<p><b>Dialysis and Transplantation</b></p> <p><b>Height</b></p> <ul style="list-style-type: none"> <li>• 37% start dialysis (height z score &lt; -1.88)</li> <li>• Decreases over time</li> <li>• Youngest have worst height scores</li> <li>• Median -1.8 to -1.99</li> </ul> <p><b>Weight</b></p> <ul style="list-style-type: none"> <li>• 6% start dialysis underweight (-0.2sds)</li> <li>• Worse in younger children</li> <li>• Median -0.96 to -3.5</li> </ul> <p><b>Overweight and Obesity</b></p> <ul style="list-style-type: none"> <li>• 12% overweight (BMI z score +2-3), 6% obese (BMI z score &gt;3) start dialysis</li> <li>• Prevalence Dialysis 52.5%; Transplant 27.4% overweight and obese</li> <li>• Predictors: age (6-11yrs and teenagers); duration treatment; medication use</li> <li>• Median 0.3 to -1.4</li> </ul>		<p><b>CKD</b></p> <p><b>Height</b></p> <p>Height -0.55 (US) vs. -0.2 (UK) sds 10% (eGFR &gt;30) &lt; -2.0sds</p> <p><b>Weight</b></p> <p>Weight 0.03 vs. 0.18 8%</p> <p><b>BMI</b></p> <p>0.5 (UK) 4% (&lt; -2.0sds); 13% (&gt; 2.0 sds)</p> <p><b>Overweight and obesity</b></p> <p>15-18% vs. 15-29% (BMI/age-BMI-ht-age)</p>
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Bonhuis et al; Rodig et al; Anderson et al

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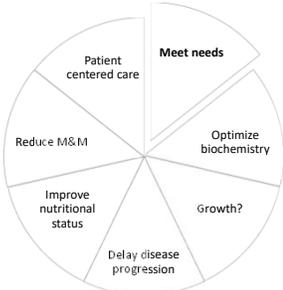
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### What are the aims of dietetic management?



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### How can we improve nutrition?

- Screen and assess nutritional status
- Monitor status and intake
- Understand our children's nutritional needs
- Standardize care
- Share knowledge and experience
- Centre care around child and their family

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## Energy and Micronutrients

**Energy requirements**  
'level of food energy intake required to **maintain** a healthy body weight in otherwise **healthy** people at existing levels of physical activity to allow for any specific needs' SACN 2011

**Micronutrients**  
"magic wands" substances needed in minuscule amounts enabling the body to produce enzymes, hormones and other substances essential for proper **growth and development**.....the consequences of their absence are severe'  
WHO <http://www.who.int/nutrition/topics/micronutrients/en/>

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## What do we need to consider?

- Gaps in our current knowledge and importance
- Differences in requirements between health and children with CKD
- Factors to consider when estimating requirements for children with CKD
- How to define, assess & measure any marker
- The consequences of excess and insufficiency
- Implications for clinical practice

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# Energy

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## How do we assess energy requirements?

**Health**

TEE total energy expenditure; BMR basal metabolic rate; PAEE physical activity energy expenditure; TEF; thermic effect of feeding; EI energy requirements  
Anderson2012

**Considerations for CKD**

**Potential factors**

- Underlying disease
- Treatment modes
- Nutritional state
- Hydration status

**Questions**

- Are we aiming for balance or growth?
- What is our clinical goal/outcome?

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## What do we know?

TEE	<ul style="list-style-type: none"> <li>• Recommended</li> <li>• No studies</li> </ul>
BMR	<ul style="list-style-type: none"> <li>• Alternative</li> <li>• 3 studies</li> </ul>
PAEE	<ul style="list-style-type: none"> <li>• Most variable component</li> <li>• No studies</li> </ul>
Energy intake	<ul style="list-style-type: none"> <li>• Alternative</li> <li>• 13 studies</li> <li>• Validity concerns</li> </ul>
EER / EAR	<ul style="list-style-type: none"> <li>• Current practice</li> <li>• Is this appropriate</li> </ul>

TEE total energy expenditure; BMR basal metabolic rate; PAEE physical activity energy expenditure; EAR estimated average requirement

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## Information considerations

Energy expenditure	Energy intake
Gaps in knowledge: disease stage and treatment	No studies specifically for energy requirements
Different methodologies	Methodology not validated
Equations not applicable today	Findings could mislead clinical practice
Theoretical concerns re expression of results	

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## Consideration review

<p><b>Considerations</b></p> <ul style="list-style-type: none"> <li>• Gaps in our current knowledge</li> <li>• Are these gaps are important</li> <li>• Differences in requirements between health and children with CKD</li> <li>• Factors to consider when estimating requirements for children with CKD</li> <li>• How to define?</li> <li>• How to assess &amp; measure?</li> <li>• Consequences of: too much and too little?</li> <li>• Implications for clinical practice</li> </ul>	<p><b>My thoughts</b></p> <ul style="list-style-type: none"> <li>• CKD stages 2-5 (no D), base initially on health requirements</li> <li>• Consider energy needed for catch up or weight loss</li> <li>• Consider stage of disease and stability: maintenance or action</li> <li>• Use EER / EAR or factorial equation (BMR+PAL = TEE) as start</li> <li>• Ask about activity and tailor needs and 'prescription' accordingly</li> <li>• Regular review mechanisms (hospital and community)</li> </ul>
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# Micronutrients




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## How do we assess micronutrients?

<p><b>Health</b></p> <ul style="list-style-type: none"> <li>• Intake             <ul style="list-style-type: none"> <li>– Dietary</li> </ul> </li> <li>• Status             <ul style="list-style-type: none"> <li>– Laboratory</li> </ul> </li> </ul>	<p><b>Considerations for CKD</b></p> <p><b>Potential factors</b></p> <ul style="list-style-type: none"> <li>• Underlying disease</li> <li>• Treatment modes</li> <li>• Nutritional state</li> <li>• Laboratory methodology</li> </ul> <p><b>Questions</b></p> <ul style="list-style-type: none"> <li>• Can we and when should we measure?</li> <li>• Are we aiming for balance / repletion / reduction?</li> <li>• What is our clinical goal/outcome?</li> </ul>
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## What do we know?

**Little information**

- Vitamins and trace elements
- Importance in co-factors in metabolic reactions and growth
- Evidence is largely dietary recall
- ~10% underestimation with dietary recall
- Dietary recall traditionally first sign of 'at risk' for nutritional deficiencies

**Guidelines**

- Stage 2 to 5:
- Aim 100% 'normal' (RNI) requirements
- Supplement if <100%
- Stage 5D: water soluble vitamin losses

**Current practice**

- PRING debate clinical practice: 100% RNI
- Local and national evidence and expert opinion
- KDOQI: 100% EER

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## What do we NOT know in CKD?

Gaps	Implications for clinical practice
Children	<ul style="list-style-type: none"> <li>• Do different ages, stages of disease and underlying diagnosis needs different prescriptions?</li> <li>• What happens over time?</li> <li>• If intake is low but stores of normal or high what should we do?</li> <li>• Should we measure status, when and how often?</li> </ul>
All ages and stages of disease	
Body stores / levels	
Links between intake and body stores	
Links between levels and kidney function	

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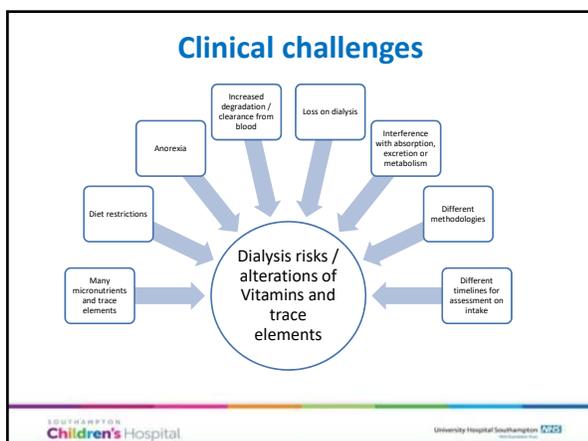
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### Key points

**What does this mean**

**Intake**

- Range of intake
- Most < RNI
- Extreme intake need closer inspection

**Serum status**

- Less extreme values
- Vitamin D ↓
- Manganese, Vitamin A & E ↑

**Relationship with kidney function**

- Diet: ↓ Sodium, Calcium, Phosphate ↓ KF
- Serum status: ↑ Vit E, A and Mn ↓ KF

**Clinical use**

**Clinical practice**

- Check micronutrient intake at each assessment
- If repeated < RNI/RI and other concerns checks 'labs'
- Consider type of supplementation

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### What do we need to consider?

**Considerations**

- Gaps in our current knowledge
- Are these gaps are important
- Differences in requirements between health and children with CKD
- Factors to consider when estimating requirements for children with CKD
- How to define?
- How to assess & measure?
- Consequences of: too much and too little?
- Implications for clinical practice

**My thoughts**

- CKD stages 2-5 aim for 100% health – no evidence otherwise at present
- Consider nutrients relationship with kidney function and potential abnormalities
- Consider mode of treatment and its effects on status and intake
- If you measure how are you going to act??
- How and when to monitor and review data and link to outcomes
- How to embed measurements into a structured approach to care
- Supplement across the range or nutrient specific, and for how long?
- Medication bioavailability and include in assessments

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## Reflection on current practice

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### Thoughts to consider

**'What we eat'**

- Food diaries accuracy ? (under reporting)

**'What we are'**

- Body composition considerations: Lean and Fat status needs to be measured, but.....
- Unknown plasma levels – need evidence

**'What we do'**

- Need to capture activity and lifestyle
- Should we supplement all nutrients or specific ones? – Complete supplements and product development nationally

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### What does this mean to the renal team?

- What stage should we start treatment
- What happens over time
- How should we monitor changes
- How can we assess activity
- Need a structured approach to care

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### My take on Energy and Micronutrients

- Clinical practice is based on very little 'solid' information
- Each child is an individual
- Need to structure how we co-ordinate nutritional management to help find best practice
- Any prescription and calculation is a starting point
- Goals need to be simple and clear to all
- Monitoring is essential
- Some children won't grow and will end up on dialysis / transplanted young.....these are the challenges we need to learn from
- No I in team – Work together – need the 'doers', 'thinkers', 'activists', 'procrastinators', 'initiators' and 'completers'.
- Take time to listen and learn – others (professionals and patients)
- Great things come at the most unexpected times

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WHO definition of health:  
*“A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”*



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